EPA Superfund
Interim Action Record of Decision

Omega Chemical Corporation Superfund Site

Operable Unit 2

Los Angeles County, California

EPA ID: CAD042245001

September 20, 2011

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for

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United States Environmental Protection Agency

Region IX – San Francisco, California

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Acronyms and Abbreviations

µg/L	microgram(s) per liter
$\mu g/m^3$	microgram(s) per cubic meter
AMK	Angeles Chemical Company and McKesson Corporation facilities
AOC	Administrative Order on Consent
AOP	advanced oxidation process
ARAR	Applicable or Relevant and Appropriate Requirement
BACT	best available control technology
bgs	below ground surface
BMP	best management practice
Cal-EPA	California Environmental Protection Agency
CBMWD	Central Basin Municipal Water District
CCR	California Code of Regulations
CD	Consent Decree
CDPH	California Department of Public Health
CDWR	California Department of Water Resources
CE	central extraction
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	*Code of Federal Regulations*
COC	contaminant of concern
CWA	Clean Water Act
DCA	dichloroethane
DCE	dichloroethene
DEHP	bis(2-ethylhexyl)phthalate
DTSC	California Department of Toxic Substances Control
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
Fe	iron
FS	feasibility study
GAC	granular activated carbon
GHG	greenhouse gas
gpm	gallon(s) per minute
GSWC	Golden State Water Company
GWTP	groundwater treatment plant
H&S Code	Health and Safety Code
HEAST	Health Effects Assessment Summary Tables

HI	hazard index
HHRA	human health risk assessment
HQ	hazard quotient
HVAC	heating, ventilation, and air conditioning
kW	kilowatt(s)
IC	institutional control
IRIS	Integrated Risk Information System
IX	ion exchange
LACDHS	Los Angeles County Department of Health Services
LACSD	Los Angeles County Sanitation District
LE	leading edge
LGAC	liquid-phase granular activated carbon
MCL	maximum contaminant level
mg/L	milligram(s) per liter
Mn	manganese
msl	mean sea level
MTBE	methyl-tert-butyl-ether
NAPLs	non-aqueous phase liquids
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	non-detect
NDMA	N-Nitrosodimethylamine
NE	northern extraction
NF	nano-filtration
NL	notification level
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPV	net present value
NSF	NSF International
NWU	nonconsumptive water use
O&M	operation and maintenance
OEHHA	Office of Environmental Health Hazard Assessment
OPOG	Omega Chemical Site PRP Organized Group
OSHA	U.S. Occupational Safety and Health Administration
OSVOG	Omega Small Volume Group
OU	Operable Unit
PCE	tetrachloroethylene
PHG	public health goal
PM	particulate matter
POTW	publicly-owned treatment works
ppb	part(s) per billion

ppm	part(s) per million
PRG	preliminary remediation goal
PRP	potentially responsible party
RA	remedial action
RAO	remedial action objective
RD	remedial design
RfD	reference dose
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RME	reasonable maximum exposure
RO	reverse osmosis
ROD	Record of Decision
RWQCB	Los Angeles Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SCAQMD	South Coast Air Quality Management District
SDWA	Safe Drinking Water Act
SIP	state implementation plan
Site	Omega Chemical Corporation Superfund Site
SO_4	sulfate
SOx	sulfur oxides
SOW	Statement of Work
State	State of California
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWRCB	State Water Resources Control Board
T-BACT	best available control technology for toxics
TBC	to-be-considered
TCA	trichloroethane
TCE	trichloroethylene
TDS	total dissolved solids
UAO	Unilateral Administrative Order
UCL	upper confidence limit
USC	United States Code
USGS	U.S. Geological Survey
UST	underground storage tank
UV	ultraviolet
VFD	variable frequency drive
VOC	volatile organic compound
WQO	water quality objective
WRD	Water Replenishment District

Part 1
Declaration

Part 1 – Declaration

1.1 Site Name and Location

The Omega Chemical Corporation Superfund Site (Site) is located in Los Angeles County, California (Comprehensive Environmental Response, Compensation, and Liability Information System [CERCLIS] ID No. CAD042245001). Operable Unit (OU) 2 of the Site is the contamination in groundwater generally downgradient and originating from the former Omega Chemical Corporation (Omega Chemical) facility in Whittier, California, much of which has commingled with chemicals released at other areas overlaying the OU2 groundwater plume. See Figure 1 for the location of OU2.

1.2 Statement of Basis and Purpose

This Record of Decision (ROD), issued by the United States Environmental Protection Agency, Region IX (EPA), selects an Interim Remedy for OU2 of the Omega Chemical Corporation Superfund Site, in Los Angeles County, California. The selected remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Contingency Plan (NCP). This decision is based on the Administrative Record (AR) for the Site. The State of California (State), represented by the Department of Toxic Substances Control (DTSC), concurs with the Interim Remedy.

1.3 Assessment of the Site

EPA has determined that hazardous substances, pollutants or contaminants have been released into groundwater within OU2, and that a substantial threat of spreading of the release into unimpacted portions of the aquifer exists. The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 Description of the Selected Remedy

EPA's selected Interim Remedy for OU2 of the Site is a groundwater pump and treat system intended to limit the movement of contaminated groundwater. The overall objective of the Interim Remedy is to protect human health and environment by preventing further spreading of the contaminated groundwater to as yet uncontaminated portions of the aquifer and nearby production wells. Following selection of the remedial action for OU2, EPA will conduct further studies and expects to propose additional remedial actions for the OU2 plume as part of the final cleanup remedy for the Site. As part of those studies, EPA will work with the State to identify and address all significant sources within the OU2 plume area that have contributed to the groundwater contamination. Most of the known sources are currently being addressed by State-led actions. EPA expects that the rest of the sources will be addressed by the combined efforts of the State and EPA.

There are three primary goals, or Remedial Action Objectives (RAOs), developed for the Interim Remedy for OU2:

1. Prevent unacceptable human exposure to groundwater contaminated by contaminants of concern (COCs);
2. Prevent lateral and vertical spreading of COCs in groundwater at OU2 to protect current and future uses of groundwater; and
3. Prevent lateral and vertical migration of groundwater with high concentrations of COCs into zones with currently lower concentrations of COCs to optimize the treatment of extracted groundwater.

In addition, the Interim Remedy is expected to begin the process of restoring the contaminated aquifer by removing contaminant mass from the groundwater.

Because this action is considered “interim”, EPA is not setting numeric cleanup goals for the groundwater in the aquifer (i.e., “in situ” cleanup goals) at this time.

The scope of the Interim Remedy does not include restoration of the aquifer, in part because of the following:

- There are known sources that have contributed to groundwater contamination within OU2 other than the former Omega Chemical facility at 12504 and 12512 Whittier Boulevard, and cleanup actions have not yet been selected for some of those sources. Most of the known sources are currently being addressed by State-led actions. In addition, there are other potential but unconfirmed source areas contributing to the OU2 groundwater contamination, which necessitate continued coordination with the State and possible further investigation to evaluate restoration of the aquifer. EPA will continue to work with the State to identify and address these other source areas.
- Additional data are needed in some areas of the aquifer where the extent of contamination will need to be better defined before EPA can determine whether any additional actions are needed to address these other areas of groundwater contamination.

EPA will continue to work closely with the State to ensure that contaminant source areas within OU2 have been addressed. Collaboration with the State will ensure that the plume containment achieved by this Interim Remedy will be sustained and that source control actions are consistent with the final remedy for the OU2 plume. The area of highly contaminated groundwater within OU1 of the Site is currently being controlled by a pump-and-treat system that began operation in July 2009. In addition, the work for design and construction of the soil remedy for OU1 (soil vapor extraction [SVE] throughout the vadose zone) began in 2010.

Components of the Interim Remedy for OU2 include the following:

- Installation of extraction wells;
- Construction of groundwater treatment facilities and associated piping;
- Delivery of treated water to one or more local drinking water purveyors, pending future stakeholder negotiations, or, if EPA determines the required agreement(s) cannot be reached in a timely manner, reinjection of the treated water into the aquifer;

- Institutional controls (ICs) for the purpose of minimizing the risk that future pumping from production wells would interfere with the containment objectives of this Interim Remedy; and
- Installation of new groundwater monitoring wells.

1.5 Statutory Determinations

The selected remedial action is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and uses permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants through treatment).

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite (i.e., in groundwater) above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD Certification Checklist

The following information is presented in the Decision Summary section (Part 2 of this ROD). Additional information can be found in the administrative record file for the Site.

- COCs and their respective concentrations (see Sections 2.5 and 2.7).
- Baseline risk represented by the COCs (see Section 2.7).
- How source materials constituting principal threats are addressed (see Section 2.11).
- Current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (see Sections 2.6 and 2.7).
- Potential groundwater use that will be available at the Site as a result of the selected remedy (see Section 2.12).
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (see Section 2.12).
- Key factors that led to selecting the remedy (i.e., how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria) (see Section 2.12).

This ROD does not establish cleanup levels for the COCs in the aquifer and the basis for these levels because the selected remedy is an Interim Remedy.

1.7 Authorizing Signature

This ROD documents the selected Interim Remedy for contaminated groundwater at OU2 of the Site. This remedy was selected with the concurrence of DTSC. The Assistant Director of the EPA Region IX Superfund Division has been delegated the authority to approve and sign this ROD.

Kathleen Salyer 9/20/11

Kathleen Salyer
Assistant Director, Superfund Division
California Site Cleanup Branch

Date

Part 2
Decision Summary

Part 2 – Decision Summary

2.1 Site Name, Location, and Description

The Omega Chemical Corporation Superfund Site (Site) includes the location of the former Omega Chemical Corporation (Omega Chemical), a refrigerant and solvent recycling and treatment facility located in Whittier, California, a community of approximately 85,000 people. Omega Chemical was located at 12504 and 12512 Whittier Boulevard (two adjoining parcels, referred to collectively as the Omega property), across the street from a residential neighborhood and within one mile of several schools, including three elementary schools and two high schools. The Omega property occupies Los Angeles County Assessor Tract Number 13486 (Lots 3 and 4). The facility operated from approximately 1976 to 1991, handling primarily chlorinated hydrocarbons and chlorofluorocarbons. Drums and bulk loads of waste solvents and chemicals from various industrial activities were processed at the facility. Chemical, thermal, and physical treatment processes reportedly were used to recycle the waste materials. Wastes generated from treatment and recycling activities included distillation column (still) bottoms, aqueous fractions, and non-recoverable solvents.

As a result of these operations, subsurface soil and groundwater have high concentrations of tetrachloroethylene (PCE), trichloroethylene (TCE), other chlorinated hydrocarbons, Freons, and other contaminants. PCE, TCE, and Freons also have been found in groundwater contamination extending more than 4 miles downgradient of the Omega property.

For the purpose of responding to contamination at the Site, EPA has divided it into three OUs (OU1, OU2, and OU3) as discussed in Section 2.4. OU1 includes the former Omega Chemical facility and immediate vicinity. OU2 is the contamination in groundwater generally downgradient of OU1 that originated from the former Omega Chemical facility, much of which has commingled with chemicals released at certain source areas/facilities into a continuous plume that is approximately 4 ½ miles long and 1 ½ miles wide, as shown in Figure 2 . OU3 refers to vapor intrusion from subsurface contamination that has occurred in several buildings on and near the Omega property.

EPA is the lead agency for the current and planned future groundwater remedial activities at OU2. EPA’s response activities at OU2 are and have been conducted under the authority established in CERCLA, as amended, 42 United States Code (USC) Section 9601 et seq. (also known as Superfund). The lead State agency for OU2 is DTSC. The Los Angeles Regional Water Quality Control Board (RWQCB) has provided and continues to provide substantial support, particularly with the investigation and cleanup of sources of contamination in the OU2 area. To date, the source of cleanup monies for the Site as a whole has been a mix of the Superfund trust fund and settlements with potentially responsible parties (PRPs). The expected source of cleanup monies for implementation of the selected remedy for OU2 is a settlement with PRPs.

2.2 Site History and Enforcement Activities

2.2.1 Site History

<u>Historical Use of the Former Omega Property</u>

The following summarizes ownership and use of the Omega property:

- Late 1930s – The property was undeveloped or used for agricultural purposes.
- 1951 – The property was developed; office and warehouse were constructed for Sierra Manufacturing Company. In December 1958, the Sierra Manufacturing Company sold the property to Sierra Bullets, Inc., a California corporation. Operations included manufacturing of metal-jacketed rifle and pistol projectiles and metal cups for detonation devices. A 500-gallon underground storage tank (UST) was used for storage of kerosene. TCE also was reportedly used at the site.
- 1962 - 1966 – The northern parcel (12504 Whittier Boulevard) was owned by Fred R. Rippy, Inc. (Rippy Inc.), which used the parcel for the purposes of die-making and operation of a stamping machine shop.
- 1966 - 1974 – The northern parcel was used to convert vans to ambulances. Fred R. Rippy, as an individual, was the owner of this parcel from 1966 until transferring ownership to the Fred R. Rippy Trust in 1986.
- 1974 - 1976 – The northern parcel was occupied by Bachelor Chemical Processing. Operations reportedly included the recycling of Freons.
- 1976 – Omega Chemical began leasing 12504 Whittier Boulevard.
- 1986 –The property was transferred from Fred R. Rippy, as an individual, to the Fred R. Rippy Trust.
- 1987 – Omega Chemical purchased the leased northern parcel and adjoining southern parcel (12512 Whittier Boulevard) from the Fred R. Rippy Trust.
- April 11, 1991 – Omega Chemical was ordered by the Superior Court of the County of Los Angeles to cease operation, remove all hazardous wastes, and close the facility.
- September 1991 – Omega Chemical filed Chapter 11 bankruptcy, which was dismissed on September 7, 1993.

The former Omega Chemical Corporation operated a refrigerant and solvent recycling, reformulation, and treatment facility. Drums and bulk loads of waste solvents and other chemicals from various industrial activities were treated, stored, disposed of, and/or processed at the facility to form commercial products, which sometimes were sold in the marketplace.

According to its October 29, 1990 Operation Plan for Hazardous Waste Recovery, the Omega Chemical facility maintained 11 treatment units comprising distillation columns, reactors, a wipe film processor, a liquid extractor, and a solid waste grinder. The facility also maintained 22 stainless steel tanks with capacities ranging from 500 to 10,000 gallons, and five carbon steel tanks with capacities of 5,000 gallons. Manifest records indicate approximately 18,000 tons of waste were delivered to the facility during its years of operation. The majority of the waste consisted of industrial solvents and refrigerants.

From approximately 1999 through 2002, the northern parcel (12504 Whittier Boulevard) continued under the ownership of Omega Chemical Inc. and was leased by Mr. Nicholas Stymuiank, who occupied the warehouse and stored miscellaneous equipment and materials in the warehouse and service yards.

Van Owen Holdings LLC, of Los Angeles, California, purchased the Omega property in 2003 and continues to own it. The warehouse on the northern parcel (12504 Whittier Blvd.) was converted and used by Star City Auto Body for auto body repair. Star City Auto Body continues to lease the property and uses it for automotive body repair and painting. The auto body shop also leases the small paved parking lot north of the warehouse building for automobile parking.

During the past few years, several tenants have operated at the former administrative building and the concrete-paved exterior yard / parking area south of the warehouse on the southern parcel (12512 Whittier Boulevard). C&I Electric used the property for equipment and billboard storage. Following the termination of the C&I Electric lease, Three Kings Construction occupied the property. In December 2006, L&M Pallets leased the exterior yard for pallet storage and continued to use the yard through 2007. A stone countertop/tile business leased the property thereafter for a very short time. Both the administrative building and the exterior yard were vacant as of August 2011.

<u>Historical Use of the OU2 Area</u>

The majority of the OU2 area was irrigated agricultural land in the early 1900s and agricultural use persisted through the 1950s. Commercial, industrial, and residential development started in the 1920s and 1930s. The historical industrial facilities included a number of chemical manufacturing and processing plants; an oil refinery; oil production facilities, including wells and pipelines; machine shops; and other businesses.

<u>Current Use of the OU2 Area</u>

Current industrial facilities within the OU2 area include chemical manufacturing and processing plants, a closed oil refinery, oil production wells and pipelines, railroad yard, machine shops, and other businesses. There is some residential use in the area. Land uses are not expected to change significantly in the next 20 years or longer.

The groundwater basin is an important source of drinking water for the metropolitan area east of Los Angeles, including the cities of Whittier, Santa Fe Springs and Norwalk. The use of groundwater in the basin is subject to adjudicated water rights administered by the California Department of Water Resources (CDWR), which serves as the Watermaster for the Central Basin.

2.2.2 Federal, State, and Local Site Investigations and Response Actions

Between 1984 and 1988, Omega Chemical received several notices of violations from the Los Angeles County Department of Health Services. In the 1990s, DTSC and EPA actively pursued the owner/operator of Omega Chemical to remove drums of contaminants and clean up the site.

At the request of DTSC, EPA conducted assessments of the Omega Chemical facility and property in 1993 and early 1995 to evaluate the condition of approximately 3,000 drums of unprocessed hazardous waste present on most of the available storage area on the property. In January 1995, EPA observed approximately 3,000 drums in various stages of deterioration, many of which were corroded and leaking. The drums were situated on pallets, in some cases three high, and many were weathered from years of outside storage. Leaking substances were migrating to other portions of the Omega property and offsite.

During 1995 and 1996, a group of PRPs (that later formed the Omega Chemical Site PRP Organized Group [OPOG]) undertook several response actions at the former Omega Chemical facility, including the removal of drums and collection of soil and groundwater samples.

In 2001, EPA started investigations of the extent of groundwater contamination at OU2, including periodic groundwater monitoring. The results of the initial investigations were documented in reports completed in 2002 and 2003.

In May 2004, indoor air was sampled within several buildings near the former Omega property, including Skateland, an indoor roller skating rink. The results indicated intrusion of PCE and TCE vapors into several buildings, from soil and groundwater at the Omega property. The highest levels were found in the Skateland building, where PCE measured 1,100 micrograms per cubic meter ($\mu g/m^3$), well exceeding EPA's health-protective range for long-term PCE exposure in an industrial/commercial use scenario (2.1 to 210 $\mu g/m^3$). OPOG members implemented an EPA-approved response action at Skateland by ultimately funding the purchase and demolition of the Skateland building. Indoor air monitoring of several buildings in the area near the former Omega property continues.

In 2005 and 2006, PRP members of the Omega Small Volume Group (OSVOG) installed and sampled additional groundwater monitoring wells to help characterize the plume of contaminated groundwater emanating from the Omega property.

In November 2007, with EPA oversight, OPOG completed a Remedial Investigation (RI) for OU1 soils. OPOG completed the OU1 Feasibility Study (FS) for soils in May 2008.

EPA installed additional groundwater monitoring wells, performed aquifer testing, and collected discrete groundwater, soil, and soil gas samples within the OU2 area in 2006 and 2007. In March 2009, EPA completed a draft OU2 RI Report. EPA completed the OU2 RI/FS and issued a Proposed Plan in August 2010. EPA presented the proposed Interim Remedy in a public meeting held on August 31, 2010, in Whittier, California, and held a 90-day public comment period.

EPA continues to monitor the extent of contamination in OU2, and to investigate other potential sources of contamination.

<u>Additional Investigations and Actions at OU2 Source Areas</u>

State and local regulatory agencies have identified numerous instances of releases of hazardous substances at facilities in and near the OU2 area. In an effort to identify whether or not these source areas have contributed contamination to the OU2 plume, EPA has searched and reviewed records and agency files, and performed field investigations at several of the confirmed and potential source areas identified in the OU2 plume area. EPA has determined that many source areas of significantly contaminated soils and groundwater have likely contributed contaminants to the OU2 plume. Most of the source area investigations have been performed under the oversight of State agencies (DTSC & RWQCB). EPA expects that all of the sources will be addressed by the combined efforts of the State and EPA. EPA will continue to work closely with the State to ensure that contaminant source areas within OU2 have been addressed. Collaboration with the State will ensure that the plume containment achieved by this Interim Remedy will be sustained and that source control actions are consistent with the final remedy for the OU2 plume.

History of CERCLA and State Enforcement Actions at the Site

Between 1984 and 1988, Omega Chemical received several notices of violations from the Los Angeles County Department of Health Services.

On May 9, 1995, EPA issued a Unilateral Administrative Order (UAO) to the Omega Chemical Corporation, its President, Dennis O'Meara, and to "major" generators (i.e., PRPs that sent at least 10 tons of hazardous substances to the Omega Chemical facility). The 1995 UAO was amended in September 1995, and issued to additional PRPs. Among other things, the UAO required: the removal of containers of materials and decommissioning of certain equipment at the Omega property; an investigation of the extent of soil and groundwater contamination at or from the Omega property; and removal of hazardous substances from the property. A total of 147 parties performed work under the 1995 UAO.

In September 1998, EPA proposed the Site for listing on the National Priorities List (NPL) and, on January 19, 1999, placed the Site on the NPL (64 Fed. Reg. 2950). DTSC has supported and continues to support EPA and represents the State regarding site investigation issues.

On April 1, 1999, EPA issued special notice letters to PRPs and commenced negotiation of a consent decree (CD) ultimately entered by the U.S. District Court in 2001, which required PRPs to perform a non-time-critical removal action addressing groundwater in the area of the former Omega property and an RI/FS addressing soils located at or near the Omega property. On September 30, 2005, following OPOG's completion of an engineering evaluation/cost analysis (EE/CA) report for OU1 groundwater, EPA issued an action memorandum describing the required removal action, which included groundwater extraction and treatment at or near the Omega property for purposes of containing contaminated groundwater. The 2001 CD also required payments from other defendants, in lieu of participation in the work required thereunder. OPOG has implemented the groundwater containment action pursuant to the 2001 CD.

On January 5, 2004, EPA issued a separate UAO to OSVOG, a group of 19 other major generator PRPs who sent at least 10 tons of hazardous waste to Omega Chemical. The UAO required OSVOG to install and sample additional groundwater monitoring wells to help characterize the plume of contaminated groundwater emanating from the Omega property. OSVOG complied with the UAO.

In 2005, EPA settled with 171 de minimis parties, which sent between 3 and 10 tons of hazardous substances to the former Omega Chemical facility. In 2006, EPA settled with 12 parties deemed to have limited ability to pay response costs incurred and to be incurred at the Omega Chemical Site.

In June 2008, EPA released for public comment a Proposed Plan for soil cleanup at OU1, and issued the ROD for OU1 soils on September 30, 2008. The remedy includes a soil vapor extraction (SVE) system and ICs. In 2009, EPA sent special notice letters to PRPs soliciting an offer to perform the OU1 RD/RA identified in the ROD and payment of EPA's unreimbursed response costs. In 2010, EPA signed a CD with OPOG that requires the PRP group to design, construct and operate the OU1 soil remedy, and to pay a portion of EPA's response costs.

In November 2009, EPA signed an Administrative Order on Consent (AOC) with OPOG to mitigate the vapor intrusion into buildings at OU3. The AOC has been modified twice to encompass additional buildings and response work. OPOG initiated the AOC work in December 2009; these mitigation efforts are ongoing. EPA presently oversees the ongoing OPOG OU1 and OU3 activities.

Additional Enforcement Actions at OU2 Sources Areas

Most of the known sources that have contributed to the OU2 groundwater contamination are currently under State oversight (DTSC or RWQCB) and are currently being addressed by State-led actions. EPA has issued general notice letters to PRPs at nine of these OU2 source areas. EPA assumes that the State will require source control actions at these facilities as needed and expects that, if and when additional source areas are identified, they will be addressed by the combined efforts of the State and EPA. Investigation of additional potential OU2 source areas continues.

2.3 Community Participation

Document Repositories

Site-related documents can be found in the Administrative Record file at the EPA Region 9 Superfund Records Center, located at 95 Hawthorne Street (4th Floor) in San Francisco, and at the information repository located at the Whittier Public Library at 7344 S. Washington Avenue in Whittier, California.

OU1

In June 2008, the Proposed Plan for OU1 soils and the related RI, FS, and Human Health Risk Assessment (HHRA) reports were made available to the public. A public notice was published on June 6, 2008 in the *Whittier Daily News* to notify community members about the availability of the Proposed Plan, the upcoming public meeting and the public comment period. The Proposed Plan was also mailed to the community.

The public meeting for the Proposed Plan was held June 24, 2008. At this meeting, EPA representatives presented the Proposed Plan and answered questions about the preferred alternative and issues regarding contamination at OU1. No comments or objections concerning the preferred alternative were raised at the meeting. The transcript for the public meeting is part of the Administrative Record file at the information repositories.

OU2

A fact sheet presenting a summary of the draft OU2 RI results was issued and distributed to the public in September 2009. EPA made the draft RI Report available by posting it on a file transfer protocol (FTP) site for public access. The final RI/FS was completed in August 2010 and was made available to the public. These documents also can be found in the AR file at the EPA

Region 9 Superfund Records Center, located at 95 Hawthorne Street (4th Floor) in San Francisco, and at the information repository located at the Whittier Public Library at 7344 S. Washington Avenue in Whittier, California. A public notice was published on August 12, 2010, in the *Whittier Daily News* to notify community members about the availability of the Proposed Plan, the public meeting and the duration of the public comment period. The Proposed Plan was also mailed to the community. After receiving a request from Golden State Water Company for a 30-day extension of the public comment period, EPA extended the review period through October 23, 2010, and notified the public of the extension via a notice on EPA's web page for the Site and through a public notice in the *Whittier Daily News.* After receiving a subsequent request from the office of Congresswoman Grace Napolitano for a 30-day extension of the public comment period, EPA extended the review period through November 22, 2010, and again notified the public of the extension via information posted on EPA's web page for the Site and a public notice in the *Whittier Daily News.*

The public meeting for the OU2 Proposed Plan was held August 31, 2010. At this meeting, EPA representatives presented the Proposed Plan and answered questions about the preferred alternative and contamination at OU2. Comments made on the preferred alternative during the public meeting were later included in formal comment letters submitted during the public comment period. The transcript for the public meeting is part of the Administrative Record file at the information repositories. EPA's responses to comments on its proposed cleanup plan are included in the Responsiveness Summary, which is Part 3 of this ROD.

2.4 Scope and Role of Operable Unit

2.4.1 Role of Operable Unit

This section briefly describes the Operable Units (OUs) to provide context for this Record of Decision. As is the case at many Superfund sites, the issues at the Omega Chemical Corporation Superfund Site are complex. Because of this complexity, EPA manages the Site as three OUs.

- OU1 includes the contaminated soil and groundwater at and in the immediate vicinity of the former Omega property;
- OU2 is composed of groundwater contamination outside and generally downgradient (generally south-southwest) of OU1; and
- OU3 is composed of indoor air contamination at buildings located on and near the former Omega Chemical property.

OPOG is leading the investigation and cleanup of OU1 and OU3, with EPA oversight. EPA has conducted the RI/FS for OU2, which is the subject of this ROD.

Under the 2001 CD, OPOG has designed and implemented a groundwater containment and mass removal treatment system for OU1 groundwater, which is currently operating. Construction of the groundwater treatment system was completed and full operation began in July 2009. The system consists of five extraction wells and a treatment plant. The treated water is discharged to a sanitary sewer line. From July 2009 through March 2011, the system extracted and treated approximately 11,150,000 gallons of water and removed 440 pounds of VOCs. The groundwater extraction system is monitored monthly, and quarterly reports are provided to ensure performance standards are met.

The September 2008 ROD selected a remedy to address soil and soil vapor contamination within OU1. The soil remedy will use an SVE system to remove soil contamination to reduce risk associated with exposure to contaminated soils and contaminant vapors, and to reduce the impact of the soil contamination on groundwater. OPOG began pilot studies and field testing for remedial design of the SVE system in late 2010.

In addition, under the November 2009 AOC, as modified, OPOG has undertaken a variety of measures, including the installation of an interim SVE system and a sub slab depressurization system, to address vapor intrusion at a number of buildings adjacent to the former Omega property. The vapor intrusion mitigation efforts are ongoing. EPA presently oversees the ongoing OPOG OU1 and OU3 activities.

2.4.2 Scope of Response Action

Selection and implementation of the Interim Remedy for OU2 is intended to address the contaminated groundwater in the area generally downgradient of the former Omega Chemical facility. Because the area overlying the OU2 plume is highly industrialized, the OU2 plume from the Omega property, which contains significant volatile organic compound (VOC), Freon, and 1,4-dioxane contamination, is commingled with other groundwater contaminants (including chromium, perchlorate, selenium, and fuel hydrocarbons) that are not believed to have been part of the Omega Chemical facility's operations but have been released at facilities within the OU2 area. These contaminants and others are present in OU2 groundwater at levels that exceed the maximum contaminant levels (MCLs) or State notification levels for drinking water and pose a current and potential risk to human health.

The area of highly contaminated groundwater within OU1 is controlled by an interim pump-and-treat system that began operation in July 2009, and RD/RA work on the soil remedy for OU1 (SVE throughout the vadose zone) began in 2010. The investigation and cleanup work at numerous source areas of significantly contaminated soils and groundwater at OU2 that were identified in the RI are under State oversight (DTSC or RWQCB). EPA will continue to work closely with the State to ensure that contaminant source areas within OU2 are addressed. Collaboration with the State will ensure that the plume containment achieved by this Interim Remedy will be sustained and that source control actions are consistent with the final remedy for the OU2 plume.

In this ROD, EPA is selecting an interim containment remedy for the contaminated groundwater at OU2. This will protect human health and environment by preventing further spreading of the contaminated groundwater to as yet uncontaminated portions of the aquifer and nearby production wells. Following implementation of the OU2 Interim Remedy, EPA will evaluate and, as appropriate, select additional cleanup actions for the contaminated groundwater at the Site as part of a final ROD.

The Interim Remedy will work in parallel with the actions at OU1 (soil cleanup and interim groundwater containment remedy) and the State-led cleanup actions at the source areas overlying the OU2 plume (Figure 3). This approach will allow cleanup to move forward under the State-led actions for the source areas and under EPA-led action for the commingled OU2 plume. The

Interim Remedy is expected to be consistent with the State-led actions and with the final remedy for the Site.

2.5 Site Characteristics

2.5.1 Conceptual Site Model

The conceptual site model for OU2 takes into account past spills, leaks, or other releases of hazardous contaminants that have occurred at the former Omega Chemical facility and known source areas within OU2, which have resulted in significant groundwater contamination that poses a potential risk to human health via the use of contaminated groundwater for potable water supply. The contamination from these source areas commingled into a continuous plume in groundwater.

Contaminated groundwater at OU2 is known to be present from about 40 to 100 feet below ground surface (bgs) and extends to about 200 feet bgs. The plume of contaminated groundwater extends approximately 4.5 miles generally south-southwest from the Omega property in the City of Whittier, through the City of Santa Fe Springs, and into the City of Norwalk. Within the OU2 plume, there are two mostly distinct high concentration areas of contamination where PCE concentrations exceed 500 micrograms per liter (µg/L). The RI/FS data indicate that the first high concentration area originates at the former Omega Chemical facility and extends for a distance of approximately 1 mile downgradient. The second high concentration area starts within a short distance downgradient of the first and continues for about one half mile (see Figure 2).

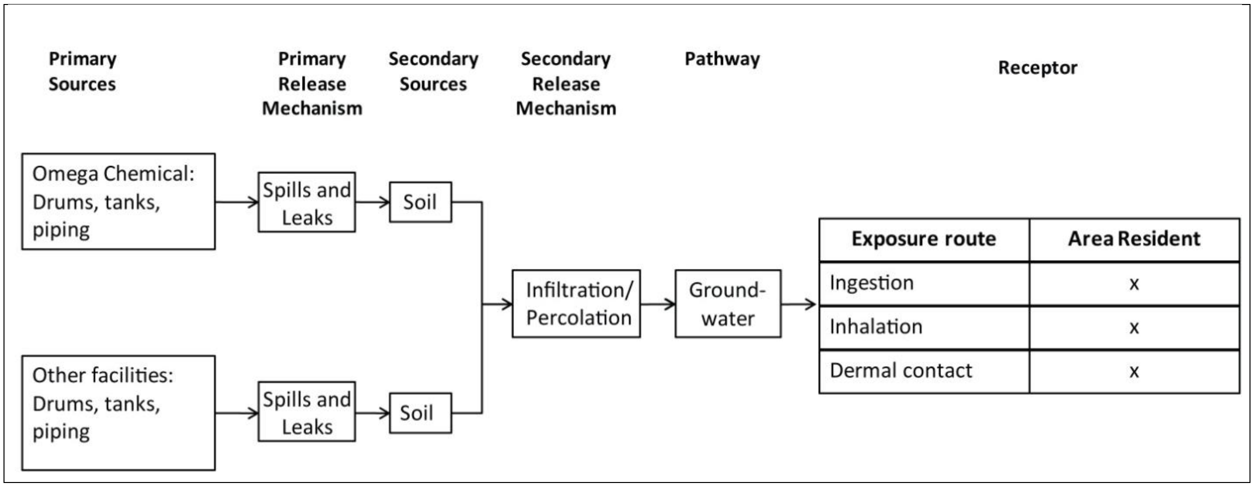
Groundwater at OU2 generally flows south and southwest. The groundwater within the OU2 area is used as a source of drinking water by several municipal and private water purveyors. Most of the drinking water wells located in the OU2 area draw water primarily from deeper portions of the aquifer at depths of 200 feet bgs or greater and are not currently impacted by groundwater contamination. However, a few drinking water wells in the area draw water at about the 200 feet bgs level and have had some contaminants detected. These wells are currently equipped with **wellhead treatment units** which consist of granular activated carbon (GAC) filters. The GAC filter removes the contaminants from the water to ensure that it meets drinking water standards. Drinking water for the cities of Whittier, Santa Fe Springs and Norwalk is tested regularly prior to distribution to the public, and, based on information EPA has been provided, all tap water meets State and Federal drinking water standards.

The HHRA results indicated that the OU2 contaminated groundwater does not pose a current or immediate risk to human health but could pose a significant potential future risk through domestic use of contaminated groundwater. Delaying action could result in the increased likelihood that additional water supply wells in the area would have to be modified, removed from service, operated intermittently, or would require treatment to remove contaminants. The conceptual site model is graphically illustrated in Figure 4.

The risk to ecological receptors from contaminants in OU2 groundwater is negligible due to the depth of groundwater. All surface water drains are at substantially higher elevations than the water table at OU2; thus, groundwater does not discharge to surface water bodies where exposure of ecological receptors otherwise could occur.

The Site and surrounding areas are nearly completely developed with a mix of predominantly commercial/industrial and minor residential land use. EPA does not expect the future land or resource uses in this area to change.

Figure 4: Conceptual Site Model for OU2



2.5.2 Overview of the Site

The former Omega Chemical Corporation was located at 12504 and 12512 Whittier Boulevard, Whittier, California. The former Omega property is approximately 41,000 square feet in area (200 ft x 205 ft) and contains two structures—a 140- by 50-foot warehouse and an 80- by 30-foot administrative building. A loading dock is attached to the rear of the warehouse. The Omega property is paved with concrete and secured with a 7-foot-high perimeter fence and locking gate. The fence is topped with razor wire.

The plume of contaminated groundwater that comprises OU2 extends from the Omega property for approximately 4.5 miles in a south-southwesterly direction (see Figure 2). The width of the contaminated groundwater plume varies from approximately 0.5 to 1 mile, and the area covered by the plume is approximately 3.3 square miles. The Omega Chemical Site and the vast majority of surrounding areas are developed with residential, industrial, or commercial facilities; very little undeveloped property remains in this area. The plume has expanded at a rate of at least 540 feet per year since 1976.

The ground surface slopes southwest from the former Omega Chemical facility at approximately 220 feet above mean sea level (msl) to approximately 150 to 160 feet above msl in the southwestern portion of OU2. Groundwater flow velocity at OU2 is approximately 620 feet per year.

2.5.3 Surface and Subsurface Features

No drums, tanks, or other features related to the operation of the former Omega Chemical Corporation remain on the property. Throughout OU2, the area is very industrialized with many facilities utilizing various containers for chemical storage.

No areas of archaeological or historical importance have been identified at the Site.

The Site is located in the Montebello Forebay and the Whittier area of the Central Basin, a subbasin of the Coastal Plain of Los Angeles County, California. According to Bulletin 104 published by CDWR, water-bearing sediments identified in the Whittier area extend to an approximate depth of at least 1,000 feet bgs. The main geologic units consist of recent alluvium, the upper Pleistocene Lakewood formation, and the lower Pleistocene San Pedro formation. The area downstream of the Whittier Narrows is known as the Montebello Forebay, where surface water could freely percolate into the groundwater system.

Most of the surface streams in the Central Basin are concrete lined (e.g., the Sorenson Drain) and recharge through the bottoms of these stream channels is assumed to be negligible. Exceptions to this are engineered recharge zones, the Rio Hondo and San Gabriel spreading basins and the unlined section of the San Gabriel River downgradient of the spreading basin extending approximately to Florence Avenue (Figure 5). There are no groundwater discharges to surface water bodies within OU2.

The San Gabriel and the Rio Hondo spreading basins are the major groundwater replenishment sources for the Central Basin. Numerous production wells are located within the Central Basin. Most of these production wells are screened in the deeper portion of the aquifer at depths generally greater than 200 feet bgs. Groundwater flows generally to the southwest in the Montebello Forebay and then turns to the south-southwest in the Central Basin pressure area. The groundwater flow in the Central Basin is mainly controlled by natural and artificial recharge in the Montebello Forebay and production pumping. Despite water level fluctuation over time, the general groundwater flow direction and gradient of the upper (water table) aquifer have remained relatively constant at OU2.

Shallow deposits at OU2 consist of unconsolidated sands and silts.

A numerical groundwater flow and solute transport model for OU2 was developed using FEFLOW. The model simulates groundwater flow in the study area for a period of 36 years, between water years 1971 and 2007 (October 1970 to September 2007).

The numerical modeling results support the conceptual understanding of groundwater flow and contaminant transport at OU2. The Site groundwater flow model simulated the groundwater flow conditions at OU2 and the development of the PCE plume during the historical period of operations at Omega Chemical.

The Site model was used to estimate the minimum extraction rates needed to achieve containment under two pumping scenarios. The targeted area of hydraulic containment is the footprint of the OU2 plume, and the targeted depth is the known contaminated portion of the OU2 aquifer; that is, to a depth of about 200 feet bgs.

2.5.4 Sampling Strategy

EPA began the remedial investigation at OU2 in 2001, with the majority of the groundwater data collected in 2007. One-time discrete groundwater samples were collected during the initial investigations and permanent wells were subsequently installed near the plume edges and for the characterization of source areas at OU2. Semi-annual groundwater monitoring and additional investigation of additional potential sources of contamination continues.

EPA has installed 30 monitoring well clusters, each consisting of one to four wells for a total of 62 well screens. Under EPA direction, OPOG installed 14 additional monitoring wells. Historical sampling included a wide range of analytes including semivolatile organic compounds (SVOCs), metals, inorganics, pesticides, and emergent contaminants. All monitoring wells are currently sampled semiannually for VOCs.

Over 200 one-time HydroPunch® groundwater samples were collected at OU2.

Eleven pumping tests and over 60 slug tests were conducted on the monitoring wells to characterize the aquifer properties at OU2.

In addition to groundwater sampling performed for Site investigations, there are several facility-specific investigations that have been performed in the OU2 area, under the direction of EPA, RWQCB, and/or DTSC. Many of these investigations included collection and analysis of groundwater, soil, and soil vapor samples to delineate contamination in the shallow aquifer, and near-surface and deep soils at facilities identified as potential source areas for COCs.

EPA completed the RI/FS for OU2 and issued an RI/FS Report in 2010 that presents the results of OU2 investigations.

2.5.5 Contaminant Source Areas

The Omega Chemical contaminants are chemicals found at concentrations exceeding their screening levels at OU1 area monitoring wells, including OW1A, OW1B, OW2, OW3A, OW3B, OW8A, and OW8B located in the immediate vicinity of the former Omega Chemical facility. The Omega Chemical contaminants are believed to have been introduced to groundwater as a result of the release of hazardous substances at the former Omega Chemical facility. The hazardous substances released at the Omega property have entered into the aquifer, and while migrating with groundwater flow, have commingled with contaminants resulting from releases of hazardous substances at other source areas. Numerous confirmed and potential source areas are described in the RI Report. Many of the investigations and source remediation activities are still in progress and will continue because they are important to ensure that the groundwater remedy is maximally effective and the groundwater quality improvements gained by the remedy are sustained over time. As source areas are more fully delineated or if more are identified, EPA will coordinate with the State to identify the appropriate lead agency for investigation and cleanup work. Most of the major chemical constituents in the releases at Omega Chemical and the releases from downgradient sources are the same (e.g., PCE and TCE). Freon 11 and Freon 113, however, are considered signature Omega Chemical contaminants because the former Omega Chemical facility is the only confirmed source of Freon releases that have impacted OU2 groundwater.

COCs for OU2 are defined as chemicals found at OU1 and OU2 at concentrations exceeding their screening levels (e.g., Federal or California primary MCL or California Department of Public Health [CDPH] Notification Level) (Table 5-5 of the RI Report). They may have originated from the former Omega Chemical facility or from other known and unknown sources. Regardless of their origins, the COCs in extracted groundwater must be addressed by the OU2 Interim Remedy. For example, a potential remedy based on groundwater extraction would require the treatment for most if not all of these compounds in order to meet the requirements associated with the end use of the treated water.

Omega Chemical contaminants in groundwater generally extend laterally up to about 4.5 miles south-southwest from the Omega property. The plume extents vary among the different COCs.

2.5.6 Types of Contamination and Affected Media

The Omega Chemical Corporation operated a refrigerant and solvent recycling, reformulation, and treatment facility. Drums and bulk loads of waste solvents and other chemicals from various industrial activities were processed at the facility.

Wastes accepted by Omega Chemical included organic solvents and chemicals and aqueous wastes with organic waste constituents. The incoming wastes were generated by a wide assortment of manufacturing and industrial processes (such as petroleum refining, rubber and plastics, chemical, paper and allied products, furniture and fixture products, lumber and wood products, printing and publishing, textile mill products, and food and kindred products).

As a result of the operations, and spills and leaks of various chemicals, the soil and groundwater beneath the Omega property became contaminated with high concentrations of tetrachloroethylene (PCE), trichloroethylene (TCE), Freons 11 and 113 and other contaminants including 1,4-dioxane. The contaminated groundwater extends four and one-half miles generally downgradient (south / southwest) of the Omega property.

The target medium for EPA's Interim Remedy for OU2 is contaminated groundwater. The chemicals of concern are mobile in groundwater, toxic, and many of them are known or suspected human carcinogens.

The OU2 plume covers an area of approximately 3.3 square miles and extends from the water table that occurs at approximately 40 to 100 feet bgs to more than 200 feet bgs in some places. Assuming an average thickness of 100 feet for the purposes of estimating the contaminated zone, the volume of the contaminated aquifer is approximately 340,000,000 cubic yards.

Among all the COCs at the Site, PCE and TCE have the greatest plume extents with the highest contaminant concentrations. PCE, a human carcinogen, is the main risk driver associated with the potential ingestion of the contaminated groundwater (the risk is summarized in Section 2.7) and is the most widely present contaminant at OU2. The Freons are considered signature chemicals of the Omega Chemical facility; their plume extents are smaller than those of PCE and TCE. The greater extents of PCE and TCE plumes than those of Freon plumes are attributed to their higher source concentrations relative to the concentrations of Freons (at OU1) and also to the contributions from other sources of PCE and TCE present within OU2.

A detailed discussion of the groundwater contamination at OU2 is presented in the RI Report. The RI/FS is based on OU2 groundwater monitoring data through July 2007 (and includes some limited supplemental information gathered in early 2010 from third parties and EPA sampling). Since issuing the RI/FS report, EPA has continued routine semiannual groundwater monitoring at OU2, and the data through 2010 indicate there are no substantial changes in the overall distribution of contaminants throughout OU2 as described in the RI/FS.

A brief summary of the 14 main COCs detected during the July through August 2007 sampling event is presented as follows:

- The maximum PCE detection of 90,000 µg/L was found in Well OW1A located at the former Omega property. The PCE plume with concentrations greater than 5 µg/L extends approximately 4.5 miles downgradient south-southwest of the former Omega Chemical facility (Figure 6). PCE concentrations exceeding 100 µg/L form a relatively narrow zone that extends from the Omega property to west of the former CENCO Refinery. Two mostly distinct zones of concentrations exceeding 500 µg/L are present. One originates at the Omega property and extends approximately 1 mile southwest; the second zone is directly downgradient of the Angeles Chemical and the McKesson Corporation (AMK) sites and extends about 0.5 mile. These two facilities are adjacent and have documented releases of similar contaminants to groundwater; they are treated as one source area (AMK) in the FS. Other, more localized and much smaller zones of high PCE concentrations present west of AMK are associated with other industrial facilities.

- The maximum TCE detection of 2,600 µg/L was found in Well OW1A. TCE is also a human carcinogen. The extent and characteristics of the observed TCE plume are similar to those of the PCE plume (Figure 7). TCE concentrations up to 100 times the MCL were found to be associated with the Omega property and AMK and extend about 1 mile and 0.5 mile from each respective source area. A distinct lobe of TCE concentrations greater than 500 µg/L west of the Omega property is associated with a source area at Whittier Boulevard. Other, more localized, and much smaller zones of high TCE concentrations present west of AMK and generally co-located with zones of high PCE are associated with other industrial facilities.

- The maximum Freon 11 detection of 210 µg/L was found in Well OW5 about 0.5 mile from the former Omega property. The Freon 11 plume is narrower than PCE or TCE plumes, and it does not extend as far downgradient. No source for Freon 11 in groundwater other than the former Omega Chemical facility has been identified; Freon 11 is therefore considered a tracer compound for contamination originating at the Omega property. However, because Freon 11 is present at much lower concentrations than PCE and TCE at OU1 (i.e., the Omega Chemical contaminants source area), its extent in groundwater at OU2 is smaller than the extent of other hazardous substances from the Omega property

- The maximum Freon 113 detection of 730 µg/L was found in Well OW8A just southwest of the former Omega property. The Freon 113 plume extent is similar to the extent of the Freon 11 plume. No source for Freon 113 in groundwater other than the former Omega Chemical facility has been identified; Freon 113 is therefore considered a tracer compound for contamination originating at the Omega property. However, because Freon 113 is present at much lower concentrations than PCE and TCE at OU1 (i.e., the source area), its extent in groundwater at OU2 is smaller than the extent of other hazardous substances from the Omega property.

- The maximum 1,4-dioxane detection of 290 µg/L was found in Well OW1A. The extent of 1,4-dioxane is similar to the extent of PCE and TCE, except that it is wider. The 1,4-dioxane concentrations decrease rapidly downgradient from the Omega property; a separate zone of high concentrations extends from the AMK area.
- The maximum hexavalent chromium detection found was 200 µg/L. The extent of hexavalent chromium does not follow a pattern similar to the VOC plumes. Historical concentrations near the Omega property have been low, suggesting that the Omega Chemical facility is probably not a significant source for hexavalent chromium contamination. Separate zones of concentrations exceeding 50 µg/L extend from the Foss Plating and Phibro-Tech, Inc. facility properties.
- The maximum 1,1-dichloroethene (DCE) detection found was 710 µg/L. The extent of 1,1-DCE in groundwater was found to be similar to that of PCE and TCE, including the relatively high concentrations associated with the Omega property and the AMK area.
- The maximum cis-1,2-DCE detection found was 300J µg/L (J = estimated). Three separate zones of cis-1,2-DCE contamination above the MCL (6 µg/L) were identified, indicating the possibility of multiple sources.
- The maximum chloroform detection found was 170 µg/L. Chloroform is present at low concentrations, generally less than 1 µg/L, throughout OU2.
- The maximum carbon tetrachloride detection found was 4.7 µg/L. Detections for carbon tetrachloride extend from the Omega property about 2.5 miles to the southwest.
- The maximum 1,1-dichloroethane (DCA) detection found was 170 µg/L. Detections for 1,1-DCA extend from the Omega property about 2.7 miles to the southwest. Concentrations decrease quickly downgradient of the Omega property and are much higher at AMK.
- The maximum 1,2-DCA detection of 39 µg/L was found at Well OW8A. The 1,2-DCA plume extends about 4.5 miles from Well OW8A.
- The maximum 1,1,1-trichloroethane (TCA) detection of 2,200 µg/L was found at Well OW1A. Detections of 1,1,1-TCA extend from the Omega property about 2.5 miles southwest. High concentrations of 1,1,1-TCA are found at AMK, Site B, and Site C.

2.5.7 Location of Contamination and Potential Routes of Migration

Groundwater contamination within OU2 is known to be present from the water table (that occurs at approximately 40 to 100 feet bgs) to depths of about 200 feet bgs, although contaminants could have migrated into deeper aquifer units that exist below 200 bgs. The OU2 plume extends about 4.5 miles south of the former Omega Chemical facility and is up to about 1 mile wide.

The Site is located in the Montebello Forebay and the Whittier area of the Central Basin, a subbasin of the Coastal Plain of Los Angeles County, California. The Coastal Plain is underlain by an extensive groundwater basin in Los Angeles and Orange counties. Water-bearing sediments identified in the Whittier area extend to an approximate depth of at least 1,000 feet bgs. The main geologic units consist of recent alluvium, the upper Pleistocene Lakewood Formation, and the lower Pleistocene San Pedro Formation. The area downstream of the Whittier

Narrows is known as the Montebello Forebay, where surface water could freely percolate into the groundwater system. The non-forebay part of the Central Basin, where such percolation is restricted by shallow fine-grained sediments, is often referred to as the Pressure Area.

The groundwater flow in the Central Basin is mainly controlled by natural and artificial recharge in the Montebello Forebay and production pumping. Groundwater flows generally to the southwest in the Montebello Forebay, and then turns to the south-southwest in the Central Basin pressure area. Piezometric heads measured in OU1 and OU2 wells generally, but not always, decline with the depth of the hydrostratigraphic unit that the well is screened in, suggesting a generally downward vertical gradient.

The contaminants at OU2 are present in the dissolved phase and will continue to migrate with the regional hydraulic gradient. The contamination at OU2 has advanced at an apparent plume expansion rate of at least 540 feet per year; this rate is an estimated minimum rate and includes the combined effects of advection, sorption, dispersion, and degradation. This plume expansion rate is consistent with estimates of advective velocity of 620 feet per year. The main migration pathway starts at the former Omega property and continues generally southwest for about 2 miles, then turns more southerly. Contamination from other source areas within OU2 follows a parallel pathway. The contamination from the former Omega Chemical facility is commingled with contamination released from these other sources.

COCs are present in groundwater primarily within the coarser, more-permeable units. There is no evidence to suggest that non-aqueous phase liquids (NAPLs) are present in the subsurface within OU2, except possibly at some of the source areas.

Groundwater within the OU2 area is used as a source of drinking water by several municipal and private water purveyors. Most of the drinking water wells located in the OU2 area draw water primarily from deeper portions of the aquifer from depths at or greater than 200 feet bgs and are not currently impacted by groundwater contamination. However, a few drinking water wells in the area draw water at about the 200 feet bgs level and have had some contaminants detected. PCE and other VOC contaminants have been detected historically at five drinking water supply wells that have screens starting at 200 feet bgs (SFS Well #1, and the Golden State Water Company [GSWC] wells Pioneer #1, Pioneer #2, Pioneer #3, and Dace #1). These wells are currently equipped with wellhead treatment units which consist of granular activated carbon (GAC) filters. The GAC filter removes the contaminants from the water to ensure that it meets drinking water standards. Drinking water for the Cities of Whittier, Santa Fe Springs and Norwalk is tested regularly prior to distribution to the public and, based on information EPA has been provided, all tap water meets State and Federal drinking water standards.

2.6 Current and Potential Future Land and Water Uses

The Site and surrounding areas are almost completely developed with a mix of predominantly commercial/industrial and minor residential land use. Residential buildings are present in the southern portion of OU2 (south of Lakeland Road and west of Balsam Street), north of Washington Boulevard near its intersection with Crowndale Avenue, and west of the intersection of Lambert Road and Santa Fe Springs Road. A number of residential buildings also border OU2 on the southeast, northwest, and west. Land uses are not expected to change significantly in the next 20 years or longer.

Groundwater within the OU2 area is used as a source of drinking water by several municipal and private water purveyors. Twelve production wells are known to exist at OU2. Five of the production wells in the OU2 area (see Figure 8) are known to have been impacted by VOCs. The nearest impacted well is located 1.3 miles to the west-southwest of the Omega Chemical facility, and is owned and operated by the City of Santa Fe Springs. Four other impacted active production wells are located near the leading edge (LE) of OU2. These wells are owned and operated by GSWC.

Additional production wells exist outside (generally south and west) of OU2. Those located downgradient of OU2 are likely to become impacted by the Omega Chemical plume in the absence of a remedy that contains the plume. Contamination from sources other than the Omega Chemical plume may also be present in these wells. The use of groundwater in this basin is subject to adjudicated water rights administered by CDWR, the Watermaster for the Central Basin. The groundwater basin is an important source of drinking water for the metropolitan area east of Los Angeles, including the cities of Whittier, Santa Fe Springs and Norwalk. EPA anticipates that the need for drinking water development is expected to increase, and as restrictions on importing water to Southern California increase and imported water becomes more expensive, additional production wells will be installed in the OU2 area.

Controls on groundwater extraction and use are in effect in the Central Basin. One such control is the judgment by the Superior Court of California, County of Los Angeles (Superior Court Case No. 786,656) ("adjudication"), which established rights to extract groundwater in the Central Basin, as well as a court-appointed Watermaster with authority to administer the adjudication, including monitoring such rights and performing other functions.

In addition, entities that administer a public drinking water system are regulated by the CDPH. In general, production wells and associated water treatment and delivery facilities that supply drinking water to the public are subject to the approval by, and water quality reporting to, the CDPH. CDPH's Policy Memo 97-005 (Policy Guidance for Direct Domestic Use of Extremely Impaired Sources) establishes a process to be followed before an extremely impaired water source can be used as a drinking water supply.

Further, a permit from Los Angeles County Department of Health Services (LACDHS) is required prior to installing any well in the OU2 area. The permit covers well construction specifications and location.

These well permit requirements, drinking water regulatory controls, and the Watermaster's authority to regulate and allocate water resources, provide a degree of centralized control over groundwater use in the OU2 area.

2.7 Summary of Site Risks

At OU2, there are no potentially significant complete exposure pathways for ecological receptors. Furthermore, because the OU2 area is nearly fully developed, protected species are not present. Therefore, this section focuses on human-health risks.

As part of the OU2 RI, EPA conducted a baseline human health risk assessment. The baseline risk assessment estimates what risks the Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the baseline risk assessment for OU2.

2.7.1 Identification of COCs

The COCs that were identified at OU2 are summarized in Table 1. This table presents analytical results from EPA and OPOG monitoring wells from March 2004 to September 2006 that were evaluated for the risk assessment conducted in 2007. The 95%, 97.5% or 99% upper confidence level limit (UCL) on the arithmetic mean as recommended by EPA's 2007 ProUCL 4 User Guide was used as the exposure point concentration for all COCs. Table 1 presents the range of concentrations detected for each COC, the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the exposure point concentration (EPC) and how the EPC was derived. PCE, TCE, and 1,1-DCE are the most frequently detected COCs in OU2 groundwater.

Table 1. Summary of Chemicals of Concern and Medium Specific Exposure Point Concentrations Omega Chemical Superfund Site – OU2 **Scenario Timeframe:** Current/Future **Medium:** Groundwater **Exposure Medium:** Groundwater											
Exposure Point	Chemical of Concern	Drinking Water Standard (µg/L)	Minimum Detected Concentration (Qualifier)		Maximum Detected Concentration (Qualifier)		Units	Frequency of Detection	Exposure Point Concentration (µg/L)	Statistical Measure
Ingestion, Dermal, and Inhalation	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1,200	11		2800		µg/L	83/88	992	95% KM (Chebyshev) UCL
	1,1-Dichloroethene (1,1-DCE)	6	14		5100		µg/L	88/88	1044	95% Approximate Gamma UCL
	1,2-Dichloroethane (1,2-DCA)	0.5	0.3	J	1300		µg/L	59/88	245	97.5% KM (Chebyshev) UCL
	1,4-Dioxane (p-dioxane)	1**	0.5	J	26000		µg/L	79/88	3563	97.5% KM (Chebyshev) UCL
	Chloroform	80	2.9	J	2800		µg/L	85/88	582	97.5% KM (Chebyshev) UCL
	Tetrachloroethylene (PCE)	5	12		210000	J	µg/L	88/88	65020	99% Chebyshev (Mean, Sd) UCL
	Trichloroethylene (TCE)	5	8.4		10000		µg/L	88/88	1320	95% H-UCL
	Trichlorofluoromethane (Freon 11)	150	7		1000		µg/L	83/88	358	95% KM (Chebyshev) UCL
	1,1,2-Trichloroethane (1,1,2-TCA)	5	0.1	J	2000		µg/L	35/87	179	97.5% KM (Chebyshev) UCL
	1,1-Dichloroethane (1,1-DCA)	5	0.4	J	150	J	µg/L	62/88	37.8	97.5% KM (Chebyshev) UCL
	Carbon tetrachloride	0.5	0.1	J	1		µg/L	16/88	0.3	95% KM (t) UCL
	cis-1,2-Dichloroethene (cis-1,2-DCE)	22	0.4	J	48		µg/L	54/88	14.4	95% KM (Chebyshev) UCL
	Hexavalent chromium	50*	0.6		23.1		µg/L	45/49	9.3	95% KM (BCA) UCL

Notes:

UCL = Upper Confidence Limit on the mean

µg/L = micrograms per liter

*No MCL – value shown is the State Total Chromium MCL

**No MCL – value shown is the State notification level

KM (Chebyshev) UCL – UCL based upon Kaplan Meier estimates using the Chebyshev inequality

KM (t) UCL - UCL based upon Kaplan Meier estimates using the student t-distribution cut off value

KM (BCA) UCL – UCL based upon bias corrected accelerated bootstrap method

H – UCL – UCL based upon Land's H- statistic

Chebyshev (Mean, Sd) UCL – UCL based upon sample mean and standard deviation

2.7.2 Exposure Assessment

The major exposure pathways evaluated in the HHRA were those associated with use of contaminated groundwater as a source of domestic water supply. Receptors that could potentially be exposed to the contaminated groundwater include current and future residents that receive drinking water.

Potential use of the OU2 groundwater for domestic water supply presents risks to human health through the following pathways:

- **Ingestion** - exposure to the contaminants through ingestion of drinking water and use in food (primary exposure route for VOCs, SVOCs, and metals).

- **Inhalation** — exposure to VOCs through inhalation during activities such as bathing and dishwashing (primary exposure route for VOCs).
- **Dermal** — exposure to VOCs, SVOCs, and metals through skin during activities such as bathing (not a primary exposure pathway for VOCs).

Exposure and potential associated health risks from soil gas vapor intrusion are in general possible due to volatilization of contaminants from groundwater. EPA performed a screening level risk assessment for soil gas vapor intrusion into indoor air at one representative location for adult receptors.

2.7.3 Toxicity Assessment

Several EPA and California Environmental Protection Agency (Cal-EPA) sources were used to obtain toxicity criteria (i.e., cancer slope factors and non-carcinogenic reference doses) in this risk assessment. The list of sources includes the following:

- Integrated Risk Information System (IRIS)
- Health Effects Assessment Summary Tables (HEAST)
- Provisional National Center for Environmental Assessment, TCE Toxicity Value (from the Region 9 preliminary remediation goal [PRG] tables)
- Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database

Cancer toxicity criteria (i.e., cancer slope factors) for COCs in groundwater are presented in Tables 2.1A and 2.1B. These tables present oral cancer slope factors, dermal cancer slope factors, and inhalation unit risks for COCs.

At the time of the 2007 risk assessment, eight of the COCs were considered to be carcinogenic via ingestion: 1,2-DCA, 1,4-dioxane, chloroform, PCE, TCE, 1,1,2-TCA, 1,1-DCA, and carbon tetrachloride. Toxicity values for these carcinogens are presented in Table 2.1A. Since the time of the 2007 risk assessment, OEHHA has identified hexavalent chromium as posing a potential cancer risk via ingestion as described in the 2011 Public Health Goal (PHG) document for this chemical.Therefore, for completeness, Table 2.1A includes the new oral toxicity values for hexavalent chromium.

At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in the assessment have been extrapolated from oral values. An adjustment factor is sometimes applied and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustments are not necessary for the chemicals evaluated at this site. Therefore, the same values presented were used as the dermal carcinogenic slope factors for these contaminants. Eight of the COCs are also carcinogenic via inhalation. These COCs include 1,2-DCA, 1,4-dioxane, PCE, TCE, 1,1,2-TCA, 1,1-DCA, carbon tetrachloride, and hexavalent chromium.

Table 2.1A. Cancer Toxicity Data Omega Chemical Superfund Site – OU2 **Pathway:** Ingestion, Dermal						
Chemical of Concern	**Oral Cancer Slope Factor**	**Dermal Cancer Slope Factor (1)**	**Slope Factor Units**	**Weight of Evidence/ Cancer Guideline Description**	**Source(s)**	**Date(s) (MM/DD/YYYY)**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene (1,1-DCE)	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane (1,2-DCA)	9.1E-02	9.1E-02	1/mg/kg/day	B2	IRIS	8/27/2007
1,4-Dioxane (p-dioxane)	2.7E-02	2.7E-02	1/mg/kg/day	NA	OEHHA	8/10/2005
Chloroform	3.1E-02	3.1E-02	1/mg/kg/day	B2	OEHHA	8/10/2005
Tetrachloroethylene (PCE)	5.4E-01	5.4E-01	1/mg/kg/day	NA	OEHHA	8/10/2005
Trichloroethylene (TCE)	1.3E-02	1.3E-02	1/mg/kg/day	B2	OEHHA	6/12/2007
Trichlorofluoromethane (Freon 11)	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane (1,1,2-TCA)	7.2E-02	7.2E-02	1/mg/kg/day	NA	OEHHA	8/10/2005
1,1-Dichloroethane (1,1-DCA)	5.7E-03	5.7E-03	1/mg/kg/day	C	OEHHA	8/10/2005
Carbon tetrachloride	1.5E-01	1.5E-01	1/mg/kg/day	B2	OEHHA	8/10/2005
cis-1,2-Dichloroethene (cis-1,2-DCE)	NA	NA	NA	NA	NA	NA
Hexavalent chromium (2)	5.0E-01	5.0E-01	1/mg/kg/day	NA	OEHHA	7/27/2011

Table 2.1B. Cancer Toxicity Data **Omega Chemical Superfund Site – OU2** **Pathway:** Inhalation							
Chemical of Concern	**Unit Risk**	**Units**	**Inhalation Cancer Slope Factor**	**Units**	**Weight of Evidence/ Cancer Guideline Description**	**Source(s)**	**Date(s) (MM/DD/YYYY)**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene (1,1-DCE)	NA	NA	NA	NA	C	IRIS	8/27/2007
1,2-Dichloroethane (1,2-DCA)	2.6E-05	μg/m3	9.1E-02	1/mg/kg/day	B2	IRIS	8/27/2007
1,4-Dioxane (p-dioxane)	7.7E-06	μg/m3	2.7E-02	1/mg/kg/day	NA	OEHHA	8/10/2005
Chloroform	NA	NA	8.1E-02	1/mg/kg/day	B2	IRIS	8/27/2007
Tetrachloroethylene (PCE)	5.9E-06	μg/m3	2.1E-02	1/mg/kg/day	NA	OEHHA	8/10/2005
Trichloroethylene (TCE)	2.0E-06	μg/m3	7.0E-03	1/mg/kg/day	B2	OEHHA	6/12/2007
Trichlorofluoromethane (Freon 11)	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane (1,1,2-TCA)	1.6E-05	μg/m3	5.7E-02	1/mg/kg/day	NA	OEHHA	8/10/2005
1,1-Dichloroethane (1,1-DCA)	1.6E-06	μg/m3	5.7E-03	1/mg/kg/day	C	OEHHA	8/10/2005
Carbon tetrachloride	4.2E-05	μg/m3	1.5E-01	1/mg/kg/day	B2	OEHHA	8/10/2005
cis-1,2-Dichloroethene (cis-1,2-DCE)	NA	NA	NA	NA	D	IRIS	8/27/2007
Hexavalent chromium	1.5E-01	μg/m3	5.1E+02	1/mg/kg/day	A	OEHHA	8/27/2007

Notes for Tables 2.1A and 2.1B:

(1) Dermal slope factor is based on oral slope factor assuming 100% absorption efficiency.

(2) Values shown reflect the OEHHA Public Health Goal adopted on July 27, 2011

NA = Not available or not applicable

IRIS = Integrated Risk Information System; available at http://www.epa.gov/iris/

HEAST = Health Effects Assessment Summary Table(s); Values from EPA Region 9 PRG Table, October 2004

OEHHA = Office of Environmental Health Hazard Assessment; Online database http://www.oehha.ca.gov/risk/ChemicalDB/index.asp

Route extrapolation: Values from EPA Region 9 PRG Table, October 2004

Weight of Evidence Classification:

A - Human carcinogen

B1 - Probable human carcinogen - indicate that limited human data are available

B2 - Probable human carcinogen - indicate that sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as human carcinogen

E - Evidence of noncarcinogenecity

Non-cancer toxicity criteria (i.e., reference doses) for COCs in groundwater are presented in Tables 2.2A and 2.2B. These tables present oral, dermal, and inhalation reference doses (RfDs), and target organs for COCs. The chronic oral toxicity data are available for all COCs except 1,4-dioxane. Similar to carcinogenic data, dermal RfDs can be extrapolated from the oral RfDs applying an adjustment factor as appropriate; however, for all OU2 COCs, no adjustment was necessary. The chronic inhalation toxicity data were available for all COCs except 1,1,2-TCA, carbon tetrachloride, and cis-1,2-DCE. Oral to inhalation route extrapolation was used for 1,1,2-TCA, carbon tetrachloride, and cis-1,2-DCE toxicity values.

Table 2.2A. Non-Cancer Toxicity Data **Omega Chemical Superfund Site – OU2** **Pathway:** Ingestion, Dermal									
Chemical of Potential Concern	**Chronic/ Subchronic**	**Oral RfD**	**Oral RfD Units**	**Dermal RfD (1)**	**Dermal RfD Units**	**Primary Target Organ(s)**	**Combined Uncertainty/ Modifying Factors (2)**	**RfD:Target Organ(s)**	
								Source(s)	**Date(s) (MM/DD/YYYY)**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	Chronic	3.0E+01	mg/kg/day	3.0E+01	mg/kg/day	Neurological	10/1	IRIS	8/27/2007
1,1-Dichloroethene (1,1-DCE)	Chronic	5.0E-02	mg/kg/day	5.0E-02	mg/kg/day	Liver	100/1	IRIS	9/13/2007
1,2-Dichloroethane (1,2-DCA)	Chronic	2.0E-02	mg/kg/day	2.0E-02	mg/kg/day	Decreased survival	NA	NCEA	10/20/2004
1,4-Dioxane (p-dioxane)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	Chronic	1.0E-02	mg/kg/day	1.0E-02	mg/kg/day	Liver	1000/1	IRIS	8/27/2007
Tetrachloroethylene (PCE)	Chronic	1.0E-02	mg/kg/day	1.0E-02	mg/kg/day	Liver	1000/1	IRIS	8/27/2007
Trichloroethylene (TCE)	Chronic	3.0E-04	mg/kg/day	3.0E-04	mg/kg/day	Liver	NA	NCEA	10/20/2004
Trichlorofluoromethane (Freon 11)	Chronic	3.0E-01	mg/kg/day	3.0E-01	mg/kg/day	General	1000/1	IRIS	8/27/2007
1,1,2-Trichloroethane (1,1,2-TCA)	Chronic	4.0E-03	mg/kg/day	4.0E-03	mg/kg/day	Blood	1000/1	IRIS	8/27/2007
1,1-Dichloroethane (1,1-DCA)	Chronic	1.0E-01	mg/kg/day	1.0E-01	mg/kg/day	None	1000/1	HEAST	7/31/1997
Carbon tetrachloride	Chronic	7.0E-04	mg/kg/day	7.0E-04	mg/kg/day	Liver	1000/1	IRIS	8/27/2007
cis-1,2-Dichloroethene (cis-1,2-DCE)	Chronic	1.0E-02	mg/kg/day	1.0E-02	mg/kg/day	Liver	NA	PPRTV	10/20/2004
Hexavalent chromium	Chronic	3.0E-03	mg/kg/day	3.0E-03	mg/kg/day	None	300/3	IRIS	8/27/2007

Table 2.2B. Non-Cancer Toxicity Data **Omega Chemical Superfund Site – OU2** **Pathway:** Inhalation							
Chemical of Concern	**Chronic/ Subchronic**	**Inhalation RfD**	**Inhalation RfD Units**	**Primary Target Organ(s)**	**Combined Uncertainty/ Modifying Factors**	**RfD: Target Organ(s)**	
						Source(s)	**Date(s) (MM/DD/YYYY)**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	Chronic	8.6E+00	mg/kg/day	Neurological	10/1	HEAST	7/31/1997
1,1-Dichloroethene (1,1-DCE)	Chronic	2.0E-02	mg/kg/day	Liver	100/1	OEHHA	6/12/2007
1,2-Dichloroethane (1,2-DCA)	Chronic	1.4E-03	mg/kg/day	Decreased survival	NA	NCEA	10/20/2004
1,4-Dioxane (p-dioxane)	Chronic	8.6E-01	mg/kg/day	NA	NA	OEHHA	12/XX/2000
Chloroform	Chronic	1.4E-02	mg/kg/day	Liver	1000/1	NCEA	10/20/2004
Tetrachloroethylene (PCE)	Chronic	1.0E-02	mg/kg/day	Liver	1000/1	OEHHA	08/XX/1991
Trichloroethylene (TCE)	Chronic	1.7E-01	mg/kg/day	Liver	NA	OEHHA	6/12/2007
Trichlorofluoromethane (Freon 11)	Chronic	2.0E-01	mg/kg/day	General	1000/1	HEAST	7/31/1997
1,1,2-Trichloroethane (1,1,2-TCA)	Chronic	4.0E-03	mg/kg/day	Blood	1000/1	Route Extrapolation	10/20/2004
1,1-Dichloroethane (1,1-DCA)	Chronic	1.4E-01	mg/kg/day	Kidney	1000/1	HEAST	7/31/1997
Carbon tetrachloride	Chronic	7.0E-04	mg/kg/day	Liver	1000/1	Route Extrapolation	10/20/2004
cis-1,2-Dichloroethene (cis-1,2-DCE)	Chronic	1.0E-02	mg/kg/day	Liver	NA	Route Extrapolation	10/20/2004
Hexavalent chromium	Chronic	2.2E-06	mg/kg/day	Respiratory	90/1	IRIS	8/27/2007

Notes:

(1) Dermal RfD is based on oral RfD assuming 100 % absorption efficiency.

(2) Source: IRIS

Route extrapolation: Values from EPA Region 9 PRG Table, October 2004

NA = Not available or not applicable

IRIS = Integrated Risk Information System; available at http://www.epa.gov/iris/

NCEA = National Center for Environmental Assessment; Values from EPA Region 9 PRG Table, October 2004

OEHHA = Office of Environmental Health Hazard Assessment

2.7.4 Risk Characterization

For carcinogens, risk is expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk (ELCR) was estimated from the following equation:

$$\text{Risk} = \text{CDI x CSF}$$

where:

risk	=	a unitless probability (e.g., 2 x 10-5) of an individual's developing cancer
CDI	=	Chronic daily intake averaged over 70 years (mg/kg-day)
CSF	=	Cancer slope factor $(\text{mg/kg-day})^{-1}$

An ELCR of $1\text{x}10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. The ELCR would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally accepted risk range for site-related exposures is 10^{-4} (1 in 10,000) to 10^{-6}(1 in 1000,000).

For non-carcinogens, the potential for a receptor to develop an adverse health effect is estimated by comparing the predicted level of exposure for a particular chemical (e.g., chronic daily intake) with the highest level of exposure that is considered protective (that is, its reference dose [RfD]). The ratio of the chronic daily intake (i.e., exposure) to RfD (i.e., toxicity) is termed the hazard quotient (HQ) and is calculated as follows:

$$HQ = CDI/RfD$$

where:

HQ	=	Hazard quotient
RfD	=	Reference dose (mg/kg-day)
CDI	=	Chronic daily intake (mg/kg-day)

CDI and RfD represent the same exposure period (i.e., chronic, subchronic, or short-term).

The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI > 1 indicates that site-related exposures may present a risk to human health.

2.7.4.1 Carcinogenic Risks

Potential future carcinogenic risks are estimated for the domestic use of untreated OU2 groundwater as tap water. The HHRA evaluated the RME scenario for an adult, child, and lifetime (adult plus child) resident due to ingestion, inhalation, and dermal exposure to COCs in groundwater. Table 3.1A, Table 3.2A, and Table 3.3A, provide risk estimates for each route of exposure for adult, child, and lifetime (adult plus child) resident, respectively.

The total risks from exposure to groundwater for adult, child, and lifetime (adult plus child) resident are 6×10^{-1}, 3×10^{-1}, and 9×10^{-1}, respectively. The COC contributing most to the risk is PCE in groundwater. Other COCs that contribute 1×10^{-4} or more risk to the total risk are 1,2-DCE, 1,4-dioxane, chloroform, TCE, and 1,1,2-TCA. The risk assessment indicates that if no clean-up action is taken, and an individual were to use the more highly contaminated OU2 groundwater for drinking and bathing throughout his or her lifetime, that person could have as much as a 9 out of 10 (or 90%) chance of developing cancer as a result of site-related exposure to the COCs.

2.7.4.2 Non-Carcinogenic Health Hazards

Potential future non-carcinogenic health hazards are estimated for the domestic use of OU2 untreated groundwater. The HHRA evaluated a scenario of RME for an adult and child resident due to ingestion, inhalation, and dermal exposure of COCs in groundwater. Table 3.1B and Table 3.2B provide hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients for routes of exposure) for adult and child resident respectively.

The estimated HIs for adult and child resident are greater than 1, which indicates the potential for adverse non-cancer health effects. The estimated HIs of 1,364 for an adult resident and 3,172 for a child resident indicate that the potential for adverse non-cancer effects could occur from exposure to contaminated groundwater containing 1,2-DCA, chloroform, PCE, TCE, and 1,1,2-TCA. Of these COCs, the COC contributing most to the hazard is PCE (HQ = 1,173 for an adult resident and HQ = 2,730 for a child resident).

2.7.4.3 Indoor Air Risk Summary

The screening level risk evaluation for inhalation exposure to contaminants in soil gas that are present in indoor air as a result of vapor intrusion found that the potential health risk to residents is low.

The risk evaluation was based on conditions at the Whispering Fountains Apartments, which are located in an area of OU2 where COC concentrations in groundwater are relatively high and the depth to groundwater is relatively low. These conditions are believed to present the greatest potential within the OU2 area for the migration of volatile COCs from groundwater up through the overlying soil and into residential buildings. The estimate of risk was done by using soil gas data from this location to predict the levels of soil gas COCs that could be present in indoor air as a result of vapor intrusion. Cancer risks and non-cancer health hazards were estimated for an adult receptor.

The estimated potential cancer risk for an adult resident of the Whispering Fountains Apartments ranges from 3×10^{-8} to 3×10^{-7}. These risk levels are not considered to be significant by EPA.

Estimated non-cancer hazard quotients for an adult resident of the Whispering Fountains Apartments range from 0.0002 to 0.004.

Uncertainty

The main uncertainties in the HHRA are associated with data quality, exposure estimation, and toxicological data. Given the simple potential routes for exposure in the conceptual site model, data quality control, and high COC concentrations in groundwater at OU2, these uncertainties are low for the OU2 HHRA. The uncertainties of the HHRA are discussed in detail in the RI/FS.

Table 3.1A. Risk Characterization Summary – Carcinogens
Omega Chemical Superfund Site – OU2
Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Groundwater	Groundwater	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	--	--	--	NA	--
			1,1-Dichloroethene (1,1-DCE)	--	--	--	NA	--
			1,2-Dichloroethane (1,2-DCA)	2.1×10^{-4}	1.0×10^{-3}	1.6×10^{-5}	NA	1.3×10^{-3}
			1,4-Dioxane (p-dioxane)	9×10^{-4}	--	3.2×10^{-6}	NA	9.1×10^{-4}
			Chloroform	1.7×10^{-4}	2.2×10^{-3}	1.5×10^{-5}	NA	2.4×10^{-3}
			Tetrachloroethylene (PCE)	3.3×10^{-1}	6.3×10^{-2}	1.9×10^{-1}	NA	5.9×10^{-1}
			Trichloroethylene (TCE)	1.6×10^{-4}	4.3×10^{-4}	2.8×10^{-5}	NA	6.2×10^{-4}
			Trichlorofluoromethane (Freon 11)	--	--	--	NA	--
			1,1,2-Trichloroethane (1,1,2-TCA)	1.2×10^{-4}	4.8×10^{-4}	1.1×10^{-5}	NA	6.1×10^{-4}
			1,1-Dichloroethane (1,1-DCA)	2.0×10^{-6}	1×10^{-5}	1.6×10^{-7}	NA	1.2×10^{-5}
			Carbon tetrachloride	4.4×10^{-7}	2.2×10^{-6}	1.2×10^{-7}	NA	2.7×10^{-6}
			cis-1,2-Dichloroethene (cis-1,2-DCE)	--	--	--	NA	--
			Hexavalent chromium (1)	--	--	--	NA	--
			Groundwater Risk Total =					6×10^{-1}
			Total Risk =					6×10^{-1}

Notes:

NA - Not applicable

(1) The cancer risk estimates shown in this table do not incorporate the cancer risks posed by hexavalent chromium. Since the time of the 2007 risk assessment, hexavalent chromium has been identified by OEHHA as posing a potential cancer risk via ingestion. Using the EPC of 9.3 ug/L and the new OEHHA toxicity factors, the ingestion risk from hexavalent chromium is about 4×10^{-4}.

Table 3.1B. Risk Characterization Summary - Non-Carcinogens **Omega Chemical Superfund Site – OU2** **Scenario Timeframe:** Current/Future **Receptor Population:** Resident **Receptor Age:** Adult								
				Non-Carcinogenic Hazard				
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ(s)**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	Neurological	0.0009	0.015	0.00032	0.017
			1,1-Dichloroethene (1,1-DCE)	Liver	0.57	7.2	0.078	7.8
			1,2-Dichloroethane (1,2-DCA)	Decreased survival	0.33	24	0.026	24.3
			1,4-Dioxane (p-dioxane)	NA	--	--	--	--
			Chloroform	Liver	1.6	5.7	0.14	7.4
			Tetrachloroethylene (PCE)	Liver	178	891	105	1174
			Trichloroethylene (TCE)	Liver	121	1.1	20.7	142
			Trichlorofluoromethane (Freon 11)	General	0.032	0.24	0.0061	0.28
			1,1,2-Trichloroethane (1,1,2-TCA)	Blood	1.2	6.1	0.11	7.47
			1,1-Dichloroethane (1,1-DCA)	Kidney	0.01	0.036	0.0008	0.047
			Carbon tetrachloride	Liver	0.01	0.061	0.0032	0.076
			cis-1,2-Dichloroethene (cis-1,2-DCE)	Liver	0.039	0.19	0.0049	0.24
			Hexavalent chromium	None	0.084	--	0.00088	0.085
			Liver Hazard Index =					1332
			Neurological Hazard Index=					0.017
			Kidney Hazard Index=					0.047
			Decreased Survival hazard Index =					24
			General Hazard Index=					0.28
			Blood Hazard Index =					7
			Thyroid Hazard Index =					0.12

Notes:

NA - Not applicable

Table 3.2A. Risk Characterization Summary – Carcinogens **Omega Chemical Superfund Site – OU2** **Scenario Timeframe:** Current/Future **Receptor Population:** Resident **Receptor Age:** Child								
				Carcinogenic Risk				
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Ingestion**	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	--	--	--	NA	--
			1,1-Dichloroethene (1,1-DCE)	--	--	--	NA	--
			1,2-Dichloroethane (1,2-DCA)	1.2×10^{-4}	6.1×10^{-4}	9.4×10^{-6}	NA	7.4×10^{-4}
			1,4-Dioxane (p-dioxane)	5.3×10^{-4}	--	1.9×10^{-6}	NA	5.3×10^{-4}
			Chloroform	9.9×10^{-5}	1.3×10^{-3}	8.6×10^{-6}	NA	1.4×10^{-3}
			Tetrachloroethylene (PCE)	1.9×10^{-1}	3.7×10^{-2}	1.1×10^{-1}	NA	3.4×10^{-1}
			Trichloroethylene (TCE)	9.4×10^{-5}	2.5×10^{-4}	1.6×10^{-5}	NA	3.6×10^{-4}
			Trichlorofluoromethane (Freon 11)	--	--	--	NA	--
			1,1,2-Trichloroethane (1,1,2-TCA)	7.1×10^{-5}	2.8×10^{-4}	6.3×10^{-6}	NA	3.6×10^{-4}
			1,1-Dichloroethane (1,1-DCA)	1.2×10^{-6}	5.9×10^{-6}	9.1×10^{-8}	NA	7.2×10^{-6}
			Carbon tetrachloride	2.6×10^{-7}	1.3×10^{-6}	6.6×10^{-8}	NA	1.6×10^{-6}
			cis-1,2-Dichloroethene (cis-1,2-DCE)	--	--	--	NA	--
			Hexavalent chromium	--	--	--	NA	--
			Groundwater Risk Total =					3×10^{-1}
			Total Risk =					3×10^{-1}

Notes:

NA - Not applicable

Table 3.2B. Risk Characterization Summary - Non-Carcinogens **Omega Chemical Superfund Site – OU2** **Scenario Timeframe:** Current/Future **Receptor Population:** Resident **Receptor Age:** Child								
				Non-Carcinogenic Hazard				
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Primary Target Organ(s)**	**Ingestion**	**Inhalation**	**Dermal**	**Exposure Routes Total**
Groundwater	Groundwater	Groundwater	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	Neurological	0.0021	0.036	0.00072	0.039
			1,1-Dichloroethene (1,1-DCE)	Liver	1.3	16.7	0.18	18.2
			1,2-Dichloroethane (1,2-DCA)	Decreased survival	0.78	55.9	0.06	56.8
			1,4-Dioxane (p-dioxane)	NA	--	--	--	--
			Chloroform	Liver	3.7	13.3	0.32	17.3
			Tetrachloroethylene (PCE)	Liver	416	2078	236	2730
			Trichloroethylene (TCE)	Liver	281	2.5	46.6	330
			Trichlorofluoromethane (Freon 11)	General	0.076	0.57	0.013	0.66
			1,1,2-Trichloroethane (1,1,2-TCA)	Blood	2.9	14.3	0.25	17.4
			1,1-Dichloroethane (1,1-DCA)	Kidney	0.024	0.084	0.0018	0.11
			Carbon tetrachloride	Liver	0.028	0.14	0.0073	0.18
			cis-1,2-Dichloroethene (cis-1,2-DCE)	Liver	0.092	0.46	0.011	0.56
			Hexavalent chromium	None	0.19	--	0.0026	0.2
			Liver Hazard Index =					3097
			Neurological Hazard Index=					0.039
			Kidney Hazard Index=					0.11
			Decreased Survival hazard Index =					57
			General Hazard Index=					0.66
			Blood Hazard Index =					17
			Thyroid Hazard Index =					0.29

Notes:

NA - Not applicable

Table 3.3A. Risk Characterization Summary – Carcinogens Omega Chemical Superfund Site – OU2 Scenario Timeframe: Current/Future Receptor Population: Resident Receptor Age: Child/Adult								
				Carcinogenic Risk				
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Groundwater	Groundwater	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	--	--	--	NA	--
			1,1-Dichloroethene (1,1-DCE)	--	--	--	NA	--
			1,2-Dichloroethane (1,2-DCA)	3.3×10^{-4}	1.7×10^{-3}	2.6×10^{-5}	NA	2×10^{-3}
			1,4-Dioxane (p-dioxane)	1.4×10^{-3}	--	5.1×10^{-6}	NA	1.4×10^{-3}
			Chloroform	2.7×10^{-4}	3.5×10^{-3}	2.4×10^{-5}	NA	3.8×10^{-3}
			Tetrachloroethylene (PCE)	5.2×10^{-1}	1.0×10^{-1}	3.0×10^{-1}	NA	9.3×10^{-1}
			Trichloroethylene (TCE)	2.6×10^{-4}	6.9×10^{-4}	4.3×10^{-5}	NA	9.9×10^{-4}
			Trichlorofluoromethane (Freon 11)	--	--	--	NA	--
			1,1,2-Trichloroethane (1,1,2-TCA)	1.9×10^{-4}	7.6×10^{-4}	1.8×10^{-5}	NA	9.7×10^{-4}
			1,1-Dichloroethane (1,1-DCA)	3.2×10^{-6}	1.6×10^{-5}	2.5×10^{-7}	NA	1.9×10^{-5}
			Carbon tetrachloride	7.0×10^{-7}	3.4×10^{-6}	1.8×10^{-7}	NA	4.3×10^{-6}
			cis-1,2-Dichloroethene (cis-1,2-DCE)	--	--	--	NA	--
			Hexavalent chromium	--	--	--	NA	--
			Groundwater Risk Total =					9×10^{-1}
			Total Risk =					9×10^{-1}

Notes:

NA - Not applicable

2.7.5 Basis for Action

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment, and from actual or threatened releases of pollutants or contaminants which may present an imminent and substantial endangerment to public health or welfare.

2.8 Remedial Action Objectives

The Interim Remedy for OU2 is intended to achieve the following RAOs:

1. Prevent unacceptable human exposure to groundwater contaminated by contaminants of concern (COCs);
2. Prevent lateral and vertical spreading of COCs in groundwater at OU2 to protect current and future uses of groundwater; and

3. Prevent lateral and vertical migration of groundwater with high concentrations of COCs into zones with currently lower concentrations of COCs to optimize the treatment of extracted groundwater.

In addition, the Interim Remedy is expected to begin the process of restoring the contaminated aquifer by removing contaminant mass from the groundwater.

The RAOs are based on the current and future highest beneficial use of groundwater in the OU2 area (i.e., use as a source of drinking water).

The OU2 contaminant plume is known to be spreading into less-contaminated or uncontaminated portions of the aquifer and posing a threat to downgradient water supply wells. Delaying action could result in the following:

1. Continued contaminant migration, necessitating additional treatment, increasing costs, and complicating the operation of existing or planned production water treatment facilities as well as planned interim remedy and future final remedy treatment facilities;
2. Increased likelihood that additional water supply wells in the area would have to be modified, removed from service, operated intermittently, or would require treatment to remove contaminants; and
3. Increased cost, difficulty, and time required for containment of contaminant plumes or restoration of the aquifer because continued contaminant migration would increase the volume, contaminant concentrations, and potential COCs in that contaminated groundwater.

2.9 Description of Remedial Alternatives

EPA developed and evaluated five remedial action alternatives (Alternatives 2 through 6) to address the RAOs. A No-Action alternative (Alternative 1) was also evaluated as a baseline for comparison.

2.9.1 Description of Remedial Alternative Components

The primary objectives of Alternatives 2 through 6 are to achieve the RAOs described above.

All of the action alternatives included groundwater extraction wells, water treatment systems, conveyance systems, and groundwater monitoring wells. The principal differences between the alternatives are in the location and number of groundwater extraction wells and the end use for the treated water. The treatment processes are similar but differ slightly based on the requirements for the specific end use of the treated water (i.e., drinking water, aquifer reinjection, spreading basin discharge, and reclaimed water).

2.9.2 Common Elements and Distinguishing Features of Each Alternative

The six alternatives developed for OU2 are presented in Table 4, Summary of Remedial Alternative Components. The five action alternatives are groundwater pump-and-treat systems consisting of six key components.

1. **Extraction of Contaminated Groundwater:** Each of the alternatives assumes that contaminated groundwater is pumped from the shallow aquifer (40 to 200 feet bgs).

Extraction wells would be installed to extract from 1,800 up to 2,200 gallons per minute (gpm). The alternatives vary in terms of the number and location of groundwater extraction wells. The various extraction well locations include the leading edge (LE) of the OU2 plume, the central extraction (CE) area and in the northern extraction (NE) area of the OU2 plume. The CE and NE areas are located generally downgradient of the two major high concentration areas within the plume. These locations are depicted in Figure 8. For comparing the extraction Alternatives, 2 through 6, it is assumed that the production wells that have been impacted (SFS#1 and the four GSWC production wells) will continue to operate. However, it should be noted that the interim remedy will perform more efficiently, and operate at lower extraction rates and lower cost if those wells were to stop pumping.

2. **Treatment of Groundwater to Remove Contaminants:** The groundwater treatment requirements for each of the action alternatives are driven by the end-use requirements of the treated water. The choice of one centralized treatment plant or separate smaller treatment plants at specific extraction areas or clusters of extraction areas will be determined during remedial design depending upon which approach is more cost effective and/or easier to implement. The following treatment processes were identified in the FS as being common to all the action alternatives:

   - Advanced oxidation process (AOP) for 1,4-dioxane removal;
   - Bio-liquid-phase granular activated carbon (LGAC) and conventional LGAC treatment for VOCs; bio-LGAC treatment is used for removal of partial oxidation products formed in the AOP; LGAC treatment is used for removal of residual VOCs; and
   - Membrane treatment process (nanofiltration [NF] or reverse osmosis [RO]) for removal of total chromium, hexavalent chromium, selenium, total dissolved solids (TDS), sulfate (SO_4) and aluminum, depending on the end-use requirements.

3. **Conveyance Systems to Transport Untreated and Treated Groundwater and Waste Brine:** All the action alternatives include the construction of pipelines for conveying:

   - Extracted groundwater from the extraction wells to the OU2 treatment plant;
   - Treated water to end use points; and
   - Wastewater brine from the membrane treatment process to an industrial sewer connection.

4. **Use of Groundwater after Removal of Contaminants:** The five action alternatives differ in the assumed use of the groundwater after the contaminants are removed. Alternatives 2 and 6 include delivery to a local water utility for potable water use. Negotiations and agreements during the RD phase will determine specifically which water purveyor or purveyors would receive the treated water. Alternatives 3, 4, and 5 include treated water reuse as reclaimed water, reinjection into the aquifer, and spreading basin discharge for aquifer replenishment, respectively.

5. **Groundwater Monitoring:** All of the alternatives assume the monitoring of water levels and groundwater quality to evaluate the performance of the implemented remedy and optimize its

operation. Monitoring will be conducted using existing monitoring wells, as well as newly installed monitoring wells.

For Alternative 2, it was estimated that new monitoring wells would be installed at six locations downgradient of the extraction wells, with each monitoring well cluster comprising four monitoring wells installed at different depths within the aquifer at each location for a total of 24 new monitoring wells.

For Alternatives 3, 4, 5, and 6, it was estimated that a total of 10 clusters of wells would be installed at locations downgradient of the extraction wells in the LE, CE, and NE areas, with each monitoring well cluster comprising four wells installed at different depths within the aquifer, for a total of 40 new monitoring wells.

6. **Institutional Controls:** The ICs are essentially informational ICs to reduce the possibility that production wells in the vicinity of OU2 could become contaminated and to prevent operation of the wells from interfering with the plume containment goals of the Interim Remedy. They include (1) annual notifications to all water rights holders in the Central Basin and other stakeholders, (2) periodic meetings with State and local agencies with jurisdiction over well drilling and groundwater use within the Central Basin, and (3) contemporaneous notifications by such agencies regarding groundwater extraction and well drilling, as described below.

   The annual notification provided to all water rights holders in the Central Basin would explain the goals of the Interim Remedy, the status of the remedy's implementation, the nature and extent of OU2 groundwater contamination and the most recent available groundwater data, and discuss related State or local restrictions and prohibitions on well-drilling and groundwater use without necessary approvals and permits.

   The purpose of the periodic (e.g., annual) meetings with State and local stakeholders would be to enable the periodic exchange of all available information relevant to whether operation of any production well(s) within OU2 or its vicinity is incompatible or poses a risk of incompatibility with the groundwater contamination containment goals of the Interim Remedy. Such information would include any permit(s) for well installation that had been applied for or granted in the OU2 area or vicinity and the compatibility of such permit(s) with the RAOs of the selected OU2 remedy.

   These meetings would be supplemented by an annual review of documentation maintained by the State and local entities to determine if water supply wells have been installed, or a purveyor or other water rights holder had increased groundwater production or production capacity within OU2 or its vicinity.

   Finally, the ICs include contemporaneous notification from State and local agencies with jurisdiction over well drilling and groundwater use within the Central Basin. For example, WRD could provide EPA and the entity/entities implementing the remedy with monthly pumping totals reported by water well operators. Further, LACDHS could notify EPA and such entity/ entities whenever a permit for well construction, modification or destruction has been sought. This contemporaneous notification would further reduce the possibility of contamination of OU2 area production wells and interference of well operation with plume containment goals.

Implementation of all components of these ICs is an integral part of each alternative and will be the responsibility of the party or parties implementing the remedy.

Table 4. Summary of Remedial Alternative Components Omega Chemical Superfund Site – OU2						
	Remedial Alternative					
Remedy Component	**1**	**2**	**3**	**4**	**5**	**6**
Groundwater Extraction		✓	✓	✓	✓	✓
Pipelines and Pumps (Conveyance)		✓	✓	✓	✓	✓
Groundwater Treatment Plant (GWTP) Capacity		1,800 gpm	2,000 gpm	2,000 gpm	2,200 gpm	2,000 gpm
Ion Exchange Treatment for Hexavalent Chromium			✓		✓	
AOP for 1,4-Dioxane		✓	✓	✓	✓	✓
Bio-LGAC/LGAC for VOCs		✓	✓	✓	✓	✓
NF or RO		Chromium, Hexavalent Chromium, TDS, SO_4	TDS, SO_4, Selenium	Hexavalent Chromium, Aluminum, TDS, SO_4, Other COCs	TDS, SO_4, Aluminum, Selenium	TDS, SO_4, Aluminum
Disinfection		✓	✓			✓
Groundwater Monitoring Program		✓	✓	✓	✓	✓
Institutional Controls		✓	✓	✓	✓	✓
End Use	No Action	Drinking Water	Reclaimed Water	Reinjection	Spreading Basin	Drinking Water

Alternative 1: No Action

EPA is required to evaluate a No-Action alternative under the NCP. This alternative establishes a baseline against which other alternatives can be compared. The No-Action alternative would allow the OU2 contamination to continue to migrate, although a relatively small area would be captured and treated as part of any groundwater cleanup actions at individual sources within the OU2 area overseen by the State.

Alternative 2: LE Extraction with Drinking Water End Use

Alternative 2 consists of groundwater extraction at the leading edge of the plume to prevent further migration of contaminated groundwater into the downgradient areas. This alternative is estimated to require three extraction wells, each about 200 ft deep, located at the LE area of the OU2 plume with extraction rates of approximately 600 gpm each for a total extraction rate of 1,800 gpm. The extracted contaminated groundwater would be treated to levels that comply with drinking water standards and delivered via pipeline to one or more of the municipal or private water purveyors in the OU2 area. The specific entity or entities that would receive the treated water would be identified during the remedial design phase.

The following key treatment steps would be conducted at the groundwater treatment plant (GWTP): an AOP to remove 1,4-dioxane; biological and conventional LGAC for VOC removal; and a NF membrane process for removal of total chromium and TDS, including SO_4. The groundwater in this area contains high levels of naturally occurring dissolved solids, which would be removed when the water is treated. The resulting high-salinity “brine,” a byproduct of the treatment process, would be discharged to a nearby industrial sewer line for disposal.

Other treatment process residuals include spent liquid phase granular activated carbon (LGAC), filter bags and dewatered sludge from periodic LGAC backwashing operations. The spent LGAC will be sent off site to a LGAC thermal reactivation facility so that the LGAC can be reused. Filter bags from influent water treatment and dewatered sludge from LGAC backwashing operations will be sent to offsite disposal, typically in a landfill.

Alternative 3: Plume-wide Extraction with Reclaimed Water End Use

Alternative 3 includes groundwater extraction at three locations and the delivery of treated water for use as reclaimed water for non-potable irrigation and industrial uses.

In addition to extracting groundwater at the leading edge (LE) of the OU2 plume, Alternative 3 would include extraction of groundwater at two additional locations (CE and NE) to prevent spreading of the high-concentration areas of the plume, more effectively remove groundwater contaminants and control vertical migration of the plume. Extracted groundwater would be treated at a centralized GWTP located in the vicinity of the CE extraction area (although the specific number and location of treatment plants would be determined during design). The treated water would be discharged to a reclaimed water line. The reclaimed water end use (for non-drinking purposes, such as irrigation or industrial use) under this alternative would be consistent with water conservation efforts in the Central Basin.

The extraction system under this alternative assumes there would be two NE wells with extraction rates of approximately 250 gpm each, two CE wells with extraction rates of approximately 250 gpm each and three LE wells with extraction rates of approximately 350 gpm each. The total extraction rate would be about 2,000 gpm for this plume-wide extraction scenario. At the GWTP, the groundwater would go through an ion exchange (IX) system to remove hexavalent chromium, AOP to remove 1,4-dioxane, biological and conventional LGAC to remove VOCs, and RO treatment to reduce selenium and TDS, including SO_4, to meet reclaimed water discharge limits. Only about 50 percent of the total water flow is treated in the RO process while 50 percent of the flow is bypassed around this treatment step. When blended together, the treated RO effluent and the RO bypass stream will meet end-use requirements. This alternative includes pipelines to convey treated water to a nearby reclaimed water line and to discharge waste brine from the GWTP to a nearby industrial sewer.

In addition to waste brine from RO treatment, other treatment process residuals include spent IX resin, LGAC, filter bags and dewatered sludge from periodic LGAC backwashing operations. Spent IX resin will be sent offsite for regeneration while spent LGAC will be sent off site to a LGAC thermal reactivation facility so that it can be reused. Filter bags from influent water treatment and dewatered sludge from LGAC backwashing operations will be sent to offsite disposal, typically in a landfill.

Mitigation of the lateral and vertical spreading of the plume would begin as soon as the system starts operating. The extraction wells will immediately begin to pull contaminated groundwater in the upgradient portion of OU2 into the wells which will prevent continued vertical and lateral groundwater migration of the plume.

Alternative 4: Plume-wide Extraction with Reinjection

Alternative 4 would have the same extraction well network as Alternative 3, but the treated water would be reinjected into the aquifer. As described in the FS, reinjection would have to be implemented in a manner that does not cause interference with containment of the plume and does not result in further spreading of existing plumes in the shallow aquifer. The replenishment of the drinking water aquifers under this alternative would be consistent with water conservation efforts in the Central Basin.

The extraction system under this alternative would be the same as for Alternative 3 and has a total extraction rate of approximately 2,000 gpm for the plume-wide extraction. The GWTP would incorporate the same treatment steps as in Alternative 2 except that it would use a more-robust RO system instead of an NF process to provide a higher degree of contaminant removal prior to injection of the groundwater (the specific number and location of treatment plants would be determined during design). The State of California's antidegradation policy has established water quality limits for reinjected water that are stricter than those for other water end uses. The treated water would be pumped to injection wells. Treatment process residuals and the manner in which they are handled are similar to Alternatives 2 and 3.

Alternative 5: Plume-wide Extraction with Spreading Basin Recharge

Alternative 5 is identical to Alternatives 3 and 4 with regard to extraction well locations but differs in that the treated water would be delivered to the nearby San Gabriel Spreading Basin for infiltration into the ground. More specifically, this treated water would be discharged to the unlined portions of the San Gabriel River that are part of the regional spreading basin area. From there, the treated water would infiltrate into the deep drinking water aquifers of the Central Basin. The replenishment of the drinking water aquifers under this alternative would be consistent with water conservation efforts in the Central Basin.

The extraction well system under this alternative would have an extraction rate that is about 10 percent higher than Alternatives 3 and 4 and 20 percent higher than Alternative 2. The spreading basin areas undergo routine maintenance and are not available for approximately 5 weeks per year. To ensure that the plume is adequately captured on overall annual basis, this system would pump at an overall extraction rate that is approximately 2,200 gpm to compensate for routine spreading basin maintenance periods.

The GWTP would incorporate the same treatment steps as Alternative 3 (although the specific number and location of treatment plants would be determined during design) and include IX, AOP, LGAC, and RO treatment units. As in Alternative 3, only about 50 percent of the total flow is estimated to need treatment in the RO process to meet end-use requirements. Treatment process residuals and the manner in which they are handled are similar to Alternative 3.

Alternative 6: Plume-wide Extraction with Drinking Water End Use

Alternative 6 was presented as the Preferred Alternative in the August 2010 Proposed Plan. It is similar to Alternatives 3, 4, and 5 in that it would incorporate the same plume-wide extraction scenario with groundwater extraction at the LE, CE, and NE areas. Alternative 6 also is similar to Alternative 2 in that groundwater would be treated and distributed to a municipal water supply system as drinking water. Extracted contaminated groundwater would be treated with a centralized GWTP located in the vicinity of the CE area (although the specific number and location of treatment plants would be determined during design).

The extraction system under this alternative would be the same as for Alternatives 3, 4, and 5, with a total extraction rate of about 2,000 gpm for the plume-wide extraction system. The GWTP would use the same treatment technologies as those found in Alternative 2, which would include an AOP, biological and conventional LGAC, NF membrane process, and final disinfection. Treatment process residuals and the manner in which they are handled are similar to Alternative 2.

Applicable or Relevant and Appropriate Requirements

The following are the key Applicable or Relevant and Appropriate Requirements (ARARs) that would apply to the proposed alternatives; more details for these and other ARARs are provided in Tables 9 and 10:

- **Federal Safe Drinking Water Act (SDWA), 2 USC §§ 300 et seq.** Establishes MCLs to protect the quality of water in public water systems (e.g., 5 µg/L for PCE, 5 µg/L for TCE, see Tables 12 and 13).
- **State of California Domestic Water Quality and Monitoring Regulations, 22 CCR § 64431 and § 64444.** Establishes California MCLs. Only those state standards that are identified in a timely manner, are more stringent than federal requirements, and are promulgated and uniformly applied may be relevant and appropriate (e.g., 50 µg/L for total chromium, see Tables 12 and 13).
- **California Porter-Cologne Water Quality Control Act, California Water Code § 13240.** Provides standards used to determine discharge limits if treated groundwater is reinjected or temporarily discharged to surface water.

In addition, EPA is selecting the following to-be-considered (TBC) criterion as a performance standard for the Selected Remedy:

- **CDPH Drinking Water Notification Levels.** The notification level of 1 µg/L for 1,4-dioxane would serve as a performance standard with respect to the offsite delivery of treated water for use in a public water supply system.

Estimated Costs for Remedial Alternatives

A summary of the capital, annual O&M, and net present value (NPV) cost for each alternative is presented in Table 5. These cost estimates are based on a 7 percent discount rate (essentially the interest rate on investment) and 30-year O&M period. Numerous assumptions have been made in estimating these costs. Details of the cost estimates for each alternative are provided in Appendix B of the FS.

Table 5. Summary Of Estimated Costs For Remedial Alternatives Omega Chemical Superfund Site – OU2				
Alternative	Capital Costs ($)	Annual O&M Costs ($)	Total NPV of O&M ($)	Total Estimated NPV ($)
1 – No Action	0	0	0	0
2 –LE Extraction with Drinking Water End Use	29,200,000	2,000,000	24,400,000	53,600,000
3—Plume-wide Extraction and Reclaimed Water End Use	40,100,000	3,700,000	46,400,000	86,600,000
4– Plume-wide Extraction and Reinjection End Use	41,400,000	2,600,000	31,800,000	73,200,000
5 – Plume-wide Extraction with Discharge to Spreading Basin	41,600,000	3,300,000	41,300,000	82,900,000
6 – Plume-wide Extraction with Drinking Water End Use	38,400,000	2,500,000	30,800,000	69,200,000

Notes:

(1) Capital costs and NPV have been rounded to the nearest $100,000. Annual O&M costs have been rounded to the nearest $1,000. NPV calculations assumed 30 years of O&M at 7 percent discount rate.

(2) Cost estimates were prepared based on an AOP treatment process designed to exceed the previous Notification Level (NL) of 3 μg/L for 1,4-dioxane. The NL for 1,4-dioxane has since been reduced to 1 μg/L. As a result, the AOP treatment costs for Alternatives 3, 5, and 6 will increase slightly to meet lower treatment limits. The estimated costs for Alternative 4 will not be impacted since its treatment level for 1,4-dioxane was already to a concentration below its NL. Overall, the relative cost ranking would not be impacted.

2.9.3 Expected Outcomes of Each Alternative

Alternative 1

The No-Action alternative does not contain the contaminated plume to any extent and does not achieve the RAOs. Alternative 1 serves as a baseline for comparison with the other alternatives.

Alternative 2

Alternative 2 would protect downgradient production wells from future contaminant migration, but it allows the spreading of high-concentration zones within the plume to zones of lower contaminant concentrations and does not meet the remedial action objectives. Extraction at the leading edge will not prevent upgradient contamination from migrating downgradient and possibly migrating deeper into the aquifer due to existing vertical gradients. Lateral capture could be compromised if groundwater conditions in the aquifer change. Overall, this alternative is predicted to achieve less than adequate vertical (as well as lateral) capture of the contaminated groundwater.

Alternatives 3, 4, 5, and 6

Alternatives 3 through 6 would use a plume-wide extraction well network to achieve plume containment. These alternatives would also impede the spread of contamination from high to lower concentration zones within OU2.

For Alternatives 3 through 6, plume containment would begin essentially as soon as the system starts operating. The extraction wells will immediately begin to pull contaminated groundwater throughout OU2 into the wells which will prevent continued vertical and lateral groundwater migration of the plume.

Alternative 3 would provide less overall containment than Alternatives 4, 5 and 6 because the amount of water that could be extracted would be constrained during periods of little or no demand for reclaimed water. Reclaimed water demand is seasonal, with peak demand occurring during hot weather periods and much lower demand occurring during wetter winter periods. As a result, groundwater extraction and treatment operations would likely fluctuate throughout the year based on reclaimed water demand. When reclaimed water demand is high, groundwater extraction rates will be high and plume containment will be effective. When reclaimed water demand is low, groundwater extraction rates will be low and plume containment will be compromised.

2.10 Summary of Comparative Analysis of Alternatives

The following sections summarize the comparative analysis of alternatives presented in the detailed analysis section of the August 2010 RI/FS Report. A separate section addresses each of the nine remedy selection criteria, and Table 6 presents a summary of the comparative analysis.

Table 6. Comparative Analysis of Remedial Alternatives Omega Chemical Superfund Site – OU2								
Alternative	**Protection of Human Health and Environment**	**Compliance with ARARs**	**Long-term Effectiveness and Permanence**	**Reduction of Toxicity, Mobility, or Volume Through Treatment**	**Short-term Effectiveness**	**Implementability**	**Cost (millions)**	
1 No-Action Alternative	**NO** – Provides no long-term protection of human health or the environment	NO	**LOW** – Would allow uninhibited migration of the contaminants in groundwater	Not Applicable	Not Applicable	Not Applicable		$0
2 Leading Edge Extraction with Drinking Water End Use	**NO** – Would not achieve complete capture of the plume by extraction at the leading edge; the capture in the vertical direction and lateral capture during changing hydrogeologic conditions would be uncertain.	**YES** – Meets all chemical-, location-, and action-specific ARARs.	**MEDIUM** – Would achieve partial capture because the vertical capture will likely be incomplete; would also allow contamination from high-concentration zones to migrate into less-contaminated zones within the plume; the overall plume size would initially increase, then decrease.	**MEDIUM** – The treatment would reduce the toxicity and mobility of contaminants removed from the extracted groundwater, but not to the extent provided by plume-wide extraction in Alternatives 3 through 6. Alternative 2 only extracts at the LE (at a lower total flow rate than Alternatives 3 through 6), where COC concentrations are much lower than within the more contaminated areas of OU2 that would be pumped by Alternatives 3 through 6.	**HIGH** – The remedy can be constructed within 1 year of completion of design with minimal expected impacts to the environment.	**MEDIUM** – This alternative is based on proven technologies for both construction and operation and can be modified in the future, if necessary. Water rights would not be an impediment assuming that the purveyor(s) receiving OU2 treated water use their water rights. Constructability is similar to the other alternatives. Complicated regulatory review and permitting process is expected as CDPH Policy Memo 97-005 requirements would have to be followed.	Capital Annual O&M NPV of O&M Total NPV	$29.2 $2.0 $24.4 $53.6
3 Plume-wide Extraction with Reclaimed Water End Use	**YES –** Would achieve capture through extraction along the longitudinal axis of the plume if there is sufficient year-round demand for reclaimed water; otherwise, overall plume capture efficiency would be impaired because of prolonged periods of little or no reclaimed water demand during which groundwater extraction rates would be significantly curtailed; it would permanently remove contamination from the extracted groundwater.	**YES** – Meets all chemical-, location-, and action-specific ARARs.	**HIGH** – Would achieve complete capture of the plume when operating; would impede the spread of contamination from highly contaminated zones; the downgradient portion of the plume size would initially increase, then decrease; the low seasonal reclaimed water demand would necessitate lower extraction rates, which would negatively affect the plume capture; as a result, the capture would likely be not as complete as Alternatives 4, 5, and 6.	**MEDIUM** – The treatment would reduce the toxicity and mobility of contaminants removed from the extracted groundwater; however, due to prolonged periods of reduced extraction due to low seasonal demand for reclaimed water, less contaminant mass would be removed compared to the other alternatives.	**HIGH** – The remedy can be constructed within 1 year of completion of design with minimal expected impacts to the environment.	**LOW** – This alternative is based on proven technologies for both construction and operation and can be modified in the future, if necessary. Water rights may be an issue and basin replenishment assessment fees may be incurred. Coordination with Water Replenishment District (WRD), Sanitation Districts of Los Angeles County (LACSD; main supplier of regional reclaimed water), and with purveyors would be necessary. Constructability is similar to other alternatives. All permits are expected to be acquired. This alternative has the lowest overall implementability as a stand-alone alternative. The possibility of combining this alternative with another end use alternative also has low implementability because regional reclaimed water supply far exceeds the current demand and there would be no incentive to provide additional reclaimed water to this region.	Capital Annual O&M NPV of O&M Total NPV	$40.1 $3.7 $46.4 $86.6

Table 6. Comparative Analysis of Remedial Alternatives
Omega Chemical Superfund Site – OU2

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-term Effectiveness	Implementability	Cost (millions)	
4 Plume-wide Extraction with Reinjection	**YES** – Would achieve capture through extraction along the longitudinal axis of the plume Would permanently remove contamination from the extracted groundwater	**YES** – Meets all chemical-, location-, and action-specific ARARs	**HIGH** – Would achieve complete capture of the plume; the plumewide extraction can better maintain capture during changing hydrogeological conditions than the LE-only extraction under Alternative 2; would impede the spread of contamination from highly contaminated zones; the downgradient portion of the plume would initially increase in size, then decrease	**HIGH** – The treatment provided would reduce the toxicity and mobility of contaminants removed from the extracted groundwater, and the mass of contamination removed by the extraction wells would be high.	**HIGH** – The remedy can be constructed within 1 year of completion of design with minimal expected impacts to the environment.	**MEDIUM** – This alternative is based on proven technologies for both construction and operation and can be modified in the future, if necessary. Water rights would not be an impediment, but coordination with purveyors would be necessary. Constructability is similar to the other alternatives. Regulatory agencies may require more stringent treatment than assumed in the FS. Water purveyors may oppose deep aquifer injection because of the potential to spread hypothetical, yet to be identified contaminants into the aquifer.	Capital Annual O&M NPV of O&M Total NPV	$41.4 $2.6 $31.8 $73.2
5 Plume-wide Extraction with Discharge to Spreading Basins	**YES** – Would achieve capture through extraction along the longitudinal axis of the plume; would permanently remove contamination from the extracted groundwater.	**YES** – Meets all chemical-, location-, and action-specific ARARs.	**HIGH** – Would achieve complete capture of the plume; the plumewide extraction can better maintain capture during changing hydrogeological conditions than the leading edge only extraction under Alternative 2; would impede the spread of contamination from highly contaminated zones; the downgradient portion of the plume would initially increase in size, then decrease.	**HIGH** – The treatment provided would reduce the toxicity and mobility of contaminants removed from the extracted groundwater, and the mass of contamination removed by the extraction wells would be high.	**HIGH** – The remedy can be constructed within 1 year of completion of design with minimal expected impacts to the environment.	**MEDIUM** – This alternative is based on proven technologies for both construction and operation and can be modified in the future, if necessary. Water rights would not be an impediment, but coordination with purveyors would be necessary. Constructability is similar to the other alternatives. Complicated regulatory review and permitting process is expected.	Capital Annual O&M NPV of O&M Total NPV	$41.6 $3.3 $41.3 $82.9
6 Plume-wide Extraction with Drinking Water End Use	**YES** – Would achieve capture through extraction along the longitudinal axis of the plume; would permanently remove contamination from the extracted groundwater	**YES** – Meets all chemical-, location-, and action-specific ARARs	**HIGH** – Would achieve complete capture of the plume; the plumewide extraction can better maintain capture during changing hydrogeological conditions than the leading edge only extraction under Alternative 2; would impede the spread of contamination from highly contaminated zones; the downgradient portion of the plume would initially increase in size, then decrease	**HIGH** – The treatment provided would reduce the toxicity and mobility of contaminants removed from the extracted groundwater, and the mass of contamination removed by the extraction wells would be high.	**HIGH** – The remedy can be constructed within 1 year of completion of design with minimal expected impacts to the environment.	**MEDIUM –** This alternative is based on proven technologies for both construction and operation and can be modified in the future, if necessary. Water rights would not be an impediment assuming that the purveyor(s) receiving OU2 treated water use their water rights. Constructability is similar to the other alternatives. Complicated regulatory review and permitting process is expected as CDPH Policy Memo 97-005 requirements would have to be followed.	Capital Annual O&M NPV of O&M Total NPV	$38.4 $2.5 $30.8 $69.2

2.10.1 Overall Protection of Human Health and the Environment

This criterion addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or institutional controls (ICs).

Alternatives 4 through 6 would reduce short-term and long-term risks to human health and the environment by containing the OU2 plume and preventing further spread of contamination to clean areas of the drinking water aquifers and to production wells outside of the OU2 plume. They would permanently remove contamination from the extracted groundwater and would allow for beneficial reuse of the treated water within the basin. Alternative 3 would achieve overall protection only if there is sufficient year-round demand for the reclaimed water. Since the demand for reclaimed water is typically cyclical, plume capture efficiency would be impaired and Alternative 3 would not achieve adequate overall protection.

Alternative 2 would not reduce long-term risks to human health because it will likely not achieve complete plume capture (vertical and lateral) and thus will not protect drinking water aquifers and production wells outside and within OU2. Alternative 2 would also allow migration of contaminants from higher concentrations areas within the plume to areas of lower concentration within the plume which would further degrade the water quality in production wells within the plume and near the plume boundary.

Under all the alternatives, it is assumed that the production wells that have been impacted (SFS1 and the four GSWC production wells) will continue to operate and that they will continue to require wellhead treatment systems.

Alternatives 2 and 6 would provide drinking water that meets all health-based state and federal requirements.

Alternative 1 would not provide long-term protection of human health and environment. It would allow uninhibited migration of the contaminants in groundwater to parts of the Central Basin that contain drinking water aquifers and production wells.

As summarized in Table 6, Alternatives 4, 5, and 6 would achieve overall protection of human health and the environment. Alternative 3 would achieve overall protection as long as there is sufficient year-round demand for the reclaimed water, otherwise it would not achieve overall protection. Alternative 2 would not achieve protection because it is predicted to achieve less than adequate vertical (as well as lateral) capture of the contaminated groundwater. Alternative 1 would not achieve overall protection.

2.10.2 Compliance with ARARs

Section 121(d) of CERCLA and NCP § 300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations, which are collectively referred to as ARARs, unless such ARARs are waived.

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

The "Compliance with ARARs" criterion addresses whether an alternative will meet all of the identified ARARs or other federal and state environmental statutes or provides a basis for invoking a waiver.

All alternatives, except the no-action alternative (Alternative 1), had common ARARs associated with the construction and operation of a pump-and-treat system for contaminated groundwater. Most of the ARARs are associated with the end use of treated groundwater, and management and disposal of treatment residuals. Alternatives 2 through 6 would meet all chemical-, location-, and action-specific ARARs for an interim action containment remedy.

Permits would not be required for the portion of the interim remedy conducted entirely onsite.

No chemical-, location-, or action-specific ARARs apply to Alternative 1.

Alternatives 2 through 6 would all equally satisfy ARARs.

2.10.3 Long-Term Effectiveness and Permanence

This criterion assesses the residual risk, and the ability of a remedy to maintain reliable protection of human health and the environment over time, once the RAOs are met. Residual risk can result from exposure to untreated waste or treatment residuals. The magnitude of the risk depends on the nature and quantity of the wastes and the adequacy and reliability of controls, if any, that are used to manage untreated waste and treatment residuals. For this Interim Remedy, untreated waste refers to the contaminated groundwater that is not removed (or treated) from the aquifer.

The performance of the alternatives in relation to this criterion was evaluated based on the extent to which each alternative removes contamination from the aquifer, contains the OU2 plume and prevents contaminated groundwater from migrating into clean and less-contaminated areas.

Alternatives 2, 3, 4, 5, and 6 would permanently remove contaminants from the extracted groundwater and would achieve varying, but generally high, degrees of long-term effectiveness and permanence. Alternative 2 would not remove as much contamination as the other alternatives because it would extract relatively low level contaminated groundwater from the leading edge only. Alternatives 3, 4, 5, and 6 are ranked High with respect to this criterion because the installation of extraction wells throughout the plume will result in immediate containment of the more highly contaminated groundwater and provide more certainty with respect to preventing its vertical and lateral migration.

The environmental impacts of cleanup activities were assessed and found to be about the same for each alternative (except the No Action alternative) because all the alternatives have similar energy use and extent of construction activities, and they all incorporate conservation of groundwater resources. Alternative 2, with extraction only at the leading edge, had a lower environmental footprint (because it requires less piping and energy consumption) than Alternatives 3, 4, 5, and 6.

The sustainability assessment of the action alternatives is presented in detail in Appendix C of the FS.

2.10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion addresses the preference, as stated in the NCP, for selecting remedial actions employing treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances as a principal element of the action. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

Alternative 1 would not provide any treatment and therefore ranks Low with respect to this criterion.

The treatment methods in Alternatives 2 through 6 would permanently remove contaminants from the extracted groundwater. The treatment technologies used in the development of the alternatives are based on the various end use requirements. Each would remove contaminants such as SVOCs, VOCs, 1,4-dioxane, AOP byproducts, selenium, hexavalent chromium and other metals. The treated effluent concentrations for all of the action alternatives are expected to be below MCLs and would also need to meet other applicable discharge standards.

Alternative 2 ranks lower than Alternatives 3 through 6 because Alternative 2 would only extract groundwater from the leading edge of the plume where COC concentrations are significantly lower than in the hot spot areas that are captured by the CE and NE extraction well locations included in Alternatives 3 through 6.

Alternative 3 includes plume-wide extraction, however, it would provide a lower degree of COC reductions of all the plume-wide extraction alternatives (Alternatives 3, 4, 5 and 6) because of prolonged periods of little or no extraction and treatment due to low seasonal demands for reclaimed water.

Alternatives 4, 5 and 6 include plume-wide extraction and would provide a greater degree of COC reductions than Alternatives 2 and 3. Under Alternative 4, treated effluent reinjected into the aquifer would meet the same or lower concentrations for those contaminants that are present where reinjection is occurring in the aquifer. For example, COCs not present in the deep aquifer would be treated to non-detect (ND) levels prior to reinjection so as not to degrade the water quality in the deep aquifer. A comprehensive characterization of the reinjection zone would be completed during remedial design to determine the treatment requirements.

Overall, Alternative 2 ranks the lowest of all the action alternatives for this criterion because the concentration of groundwater contamination extracted, compared to the plume-wide extraction scenarios, would be lower or less concentrated. Alternative 3, which includes plume-wide extraction, ranks higher than Alternative 2 but lower than Alternatives 4, 5 and 6 because there would be long periods of little or no extraction due to seasonal demands for reclaimed water. Alternatives 4, 5, and 6 are equal to each other for this criterion and rank higher than Alternatives 2 and 3 because they would extract and treat the most contaminated water and the largest groundwater volumes compared to the other alternatives.

2.10.5 Short-Term Effectiveness

This criterion evaluates the effects of each remedial alternative on human health and the environment during construction and operation, as well as the time required to meet the RAOs.

Alternative 1 would not include any construction or other response actions; therefore, there would be no short-term adverse impacts to the community or to human health or the environment as a result of this alternative.

Alternatives 2 through 6 would all require the construction of one treatment plant of similar size.

Alternative 2 would require the installation of extraction wells in one area (near the leading edge of the plume) and construction of an estimated 22,400 feet of pipeline. Alternatives 3 through 6 would require the installation of extraction wells throughout the plume (represented by the three areas—LE, CE, and NE), and construction of an estimated 41,700; 33,200; 40,700; and 41,900 feet of pipeline, respectively. The requirements for pipeline construction and well installation under Alternatives 3 through 6 are approximately double those for Alternative 2.

In addition, the FS estimated that Alternative 4 would require the installation of two injection wells (although the actual number would be determined during design).

It was estimated in the FS that all the remedy components could be constructed within 1 year of approval of final designs for each of the Alternatives 2 through 6. All construction activities would take place within developed areas with minimal expected impacts to the environment. Noise and dust abatement, along with management and offsite disposal of the contaminated drill cuttings and purge water would be required to minimize impacts to the community during remedy construction. Standard U.S. Occupational Safety and Health Administration (OSHA) requirements would be protective of workers during the construction.

Reduction of the environmental impacts of the selected alternative will be considered during the RD phase and integrated into the design and operation of the groundwater extraction and treatment system. For example, the use of alternative energy sources and low energy-consuming equipment (such as variable frequency motors) can be coupled with optimum pipeline routing, sizing and material selection (including the use of recycled construction materials) to lower the environmental footprint of the remedy.

Alternatives 2 though 6 rank High on short-term effectiveness. Alternative 1 is not ranked.

2.10.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation.

The No-Action Alternative is by definition implementable.

The following criteria are common to Alternatives 2 through 6:

- They are based on proven technologies for both construction and operation.
- They can meet federal, state, and local permitting requirements. Although permits would not be required for any portion of the remedial action conducted entirely onsite, compliance with the substantive aspects of all potential ARARs (including those involving permits) is required.
- They would require access to water rights obtained from a water rights holder by agreement.
- They would generate waste brine as a byproduct of the TDS reduction. Although, by policy, LACSD generally prefers not to accept groundwater into its publicly-owned treatment works (POTW) system, it is very likely that the agency would accept this wastewater because it is wastewater generated as part of a water reuse effort. This water would qualify for a Nonconsumptive Water Use (NWU) Permit, which must be renewed periodically.

Alternatives 4 and 5 do not involve consumptive water use and would require a NWU Permit for the entire extracted volume.

Treatment of groundwater from an impaired source for potable use under Alternatives 2 and 6 would require the preparation of a CDPH 97-005 permit application and implementation of its requirements, including extensive monitoring and testing provisions.

The demand for reclaimed water generated under Alternative 3 is currently much lower than the existing available supply. In addition, reclaimed water demand has high seasonal fluctuations that would impair plume capture efficiency.

The reinjection of treated water under Alternative 4 and the discharge to spreading basins under Alternative 5 would require extensive testing and a complicated regulatory review and permitting process.

The regulatory and permitting requirements are the main distinguishing factors for the implementability of Alternatives 2 through 6. Based on these factors, Alternatives 2, 4, 5, and 6 rank Medium for this criterion. For Alternative 3, however, the lack of a consistent and large enough demand for reclaimed water is problematic, resulting in a Low ranking. Alternative 1 is not ranked.

2.10.7 Cost

The estimated NPV of the alternatives, not including the No Action alternative, range from $53.6 million to $83.6 million. The main cost differences among the alternatives arise from the different lengths of pipelines, different treatment requirements driven by the end use of the treated water, and replenishment fees. Alternative 2 has the lowest capital and O&M costs because the influent VOC concentrations would be lower in comparison the influent concentrations under Alternatives 3 through 6. The capital costs for Alternatives 3 through 6 are similar due to roughly the same extraction and monitoring well network, and similar treatment plant size and length of piping. The costs for Alternative 4 include the installation of two injection wells; the cost of pipelines is lower in comparison to Alternatives 3, 5, and 6. The O&M costs for Alternative 3 include a replenishment assessment of $205 per acre-foot. The costs for Alternatives 2 and 6 exclude the replenishment assessment fee based on the assumption that the water purveyor(s) receiving the potable water from the Interim Remedy would use their existing water rights.

2.10.8 State Acceptance

DTSC, as the lead agency for the State, has concurred with EPA's choice of Alternative 6 (plume-wide extraction with drinking water end use) as the selected remedy. DTSC supports the Interim Remedy, and recognizes it is contingent upon one or more local water purveyors agreeing to accept the treated water. If an agreement with the water purveyor(s) cannot be reached in a timely manner, DTSC supports the alternative end use of reinjecting the treated water into the aquifer.

2.10.9 Community Acceptance

This criterion evaluates the issues and concerns the public expressed during the public comment period regarding each alternative. In response to various requests, EPA agreed to two extensions allowing submittal of comments on its Proposed Plan from August 23, 2010 to November 22, 2011. During that time, EPA received letters from 14 stakeholders and one local consultant with comments on the Proposed Plan. The comments from PRPs included their belief that the extent of the selected Interim Remedy is unnecessary and that a much smaller plume area should be contained. Comments from water purveyors and other stakeholders included concerns that the scope of the Interim Remedy is too limited and not sufficiently protective of production wells.

Other comments included: the desire to implement the remedy immediately to protect drinking water wells; concerns that the remedy may require extensive effort and time to implement; and concern that the length and depth of the plume, especially near the leading edge, may be further and deeper than what was determined in the RI/FS. One commenter proposed a seventh alternative. Other commenters expressed a preference for a combination of alternatives. EPA has addressed all of the significant comments received in the Responsiveness Summary, Section 3, of this ROD. EPA does not believe that any of the issues and concerns raised warrants selection of an Interim Remedy other than EPA's preferred Alternative 6.

2.11 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable. The "principal threat" concept (highly toxic or highly mobile wastes that cannot be reliably contained) is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, NAPLs in groundwater may be viewed as source material. Because OU2 is a plume of contaminated groundwater and NAPL has not been detected in groundwater in OU2, principal threat wastes are not considered to be present within OU2.

2.12 Selected Remedy

EPA's selected Interim Remedy for OU2 is Alternative 6, with added flexibility for reinjection end use as described in detail below.

2.12.1 Summary of the Rationale for the Interim Remedy

Based on the information currently available, EPA has concluded that the selected remedy meets the threshold criteria and provides the best balance of trade-offs among the remedial alternatives.

EPA's selected remedy for OU2 of the Omega Chemical Superfund Site is a groundwater pump-and-treat system with extraction wells at three locations along the plume and treatment of the contaminated groundwater for drinking water end use or reinjection of the water into the aquifer if agreements with water purveyors cannot be reached in a timely manner.

The most decisive considerations that affected the selection of the remedy were:

- The remedy will achieve significant risk reduction by containing the contaminated plume to the same degree or better than the other alternatives.
- The remedy will satisfy the RAOs of preventing the spread of contamination in the groundwater to protect future uses of groundwater and preventing migration of groundwater with high concentrations of COCs into zones with currently lower concentrations of COCs.
- The remedy will satisfy the RAO of preventing unacceptable human exposure to groundwater contaminated by COCs.
- The remedy provides permanent and significant reduction in the toxicity, mobility and volume of VOCs and other COCs in the groundwater at OU2 and, by removing contaminant mass from the groundwater, begins the process of restoring the contaminated aquifer.
- The remedy will make treated groundwater available as a source of drinking water, which is consistent with regional water conservation and reuse efforts.
- The remedy has the lowest estimated total cost of the four plume-wide containment alternatives.

The State has concurred with EPA's selected remedy in a letter dated May 26, 2011. Furthermore, the selected remedy satisfies the following statutory requirements of CERCLA Section 121(b): (1) be protective of human health and the environment; (2) comply with ARARs (or justify a waiver); (3) be cost effective; (4) use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element.

2.12.2 Description of the Interim Remedy

The following is a description of the selected remedy based on Alternative 6 (plume-wide extraction and drinking water end use) with the option for reinjection of treated water if agreements with one or more water purveyors cannot be reached in a timely manner. The Interim Remedy includes the construction of new extraction wells at three locations along the plume; construction of conveyance pipelines for sending extracted groundwater from new extraction wells to the treatment plant(s), for sending treated water to a water purveyor connection point(s) (or to new injection wells), and for sending waste brine to an industrial sewer connection; construction of a treatment plant consisting of multiple processes (the final treatment processes and sequence will be determined during remedial design); treated water disinfection; installation of new monitoring wells; and implementation of ICs. A representative schematic diagram of the expected locations of extraction wells, treatment plant, and pipelines for the selected remedy (based on the drinking water end use scenario) is provided in Figure 8. Final locations will be determined during remedial design. Additional details are provided below.

The drinking water end use for this remedy is contingent upon one or more local water purveyors agreeing to accept the treated water. If an agreement with the water purveyor(s) cannot be reached in a timely manner, the treated water will be reinjected into the aquifer.

Although EPA does not expect significant changes to this remedy, there may be some level of modification during the remedial and construction processes. Any changes to the remedy described in this ROD would be adopted and documented as appropriate and consistent with applicable regulations.

Groundwater Extraction Wells, Conveyance Pipelines, and Monitoring

The extraction well system for the selected remedy will be determined during remedial design based on achieving the RAOs and performance criteria. The following text summarizes the types of extraction wells assumed in Alternative 6 and in the remedy cost estimates. These assumptions are expected to be representative of the facilities required as part of the remedy.

Based on preliminary computer modeling conducted during the RI/FS, two CE area wells with an extraction rate of approximately 250 gpm each, two NE area wells with an extraction rate of approximately 250 gpm each, and three LE wells with an extraction rate of approximately 350 gpm each are needed to achieve the performance criteria. The total extraction rate is 2,050 gpm (nominally 2,000 gpm) for the plume-wide extraction well network. The exact locations, depths, screened intervals and pumping rates for the extraction wells will be determined during remedial design and would depend on extraction configurations needed to achieve containment of the plume and taking into account practical limitations such as access. The specific conveyance systems required for the selected remedy shall be determined during the remedial design after the extraction wells, treatment plant(s), and treated water delivery locations are finalized.

Groundwater monitoring is a key component of the selected remedy and will be carried out to (1) provide information to monitor the effectiveness of the containment system and to optimize the system performance and (2) provide early warning of upgradient changing conditions that could adversely affect system performance or necessitate system modifications, such as a change in groundwater flow conditions, a change in contaminant concentrations, or detection of new contaminants.

The existing groundwater monitoring network at Omega Chemical OU2 will be incorporated into the selected remedy. However, additional monitoring wells complementing the current monitoring network are needed to fulfill the first monitoring objective. For the purpose of cost estimation, the FS assumed that a total of 10 clusters of monitoring wells will be installed at locations downgradient of the LE, CE, and NE wells, with each well cluster comprising four wells installed at different depths within the contaminated aquifer. A total of 40 new monitoring wells was assumed; the final number of monitoring wells will be determined during remedial design.

Groundwater Treatment

The selected remedy will incorporate treatment processes that may include some or all of the following key process steps:

- AOP for 1,4-dioxane removal using ultraviolet (UV) light and hydrogen peroxide; some VOCs removed; some partial oxidation byproducts potentially formed
- Bag filters for removal of precipitates (iron [Fe], manganese [Mn]) potentially formed in AOP
- Bio-LGAC for removal of potential recalcitrant partial oxidation products formed in AOP
- LGAC for removal of residual VOCs
- NF for removal of total (and hexavalent) chromium/TDS/ SO_4
- Disinfection using chlorination to meet potable water standards
- Discharge of treated water to potable water system (or to reinjection wells)
- Discharge of NF reject brine to industrial sewer trunk line

The potential sequence of treatment processes is depicted in Figure 9, which is based on the description of Alternative 6 in the FS. The actual treatment processes and sequence will be determined during remedial design, as will the number and location of treatment plants. The treatment plant(s) design flow capacity would be 2,000 gpm, while the average flow rate would be about 1,300 gpm.

Treated Water End Use

The selected remedy calls for treated water to be distributed to one or more local water purveyors for use as drinking water. Initial discussions with the local water purveyors indicate a general willingness to accept suitably-treated water for use in potable water supply systems; however, formal agreements have not yet been negotiated. It is possible that more than one water purveyor will receive treated water. It is anticipated that negotiating the required agreement(s) will take considerable time and effort. If EPA determines the required agreement(s) cannot be reached in a timely manner, EPA may approve the alternate end use option of reinjection into the aquifer. If the selected end use becomes reinjection, additional evaluations and stakeholder negotiations shall be conducted to select the appropriate number and location of injection wells.

CDPH Policy Memorandum 97-005 establishes a specific process for the evaluation of impaired water sources before they can be approved for use as a source of drinking water. These offsite requirements that apply to COCs must be met in order to deliver treated OU2 water for use in domestic water supply. In the cost estimates developed as part of the FS, it was assumed that negotiations with the water purveyor receiving the potable water would result in the water purveyor using its water rights. The treatment process will generate a waste brine stream high in TDS, which cannot be reused and will therefore be discharged to an industrial sewer. An NWU Permit and replenishment assessment exemption could be obtained, at WRD's discretion, for the volume of water extracted that ends up as non-reusable waste brine.

Institutional Controls

ICs are non-engineering controls that will supplement engineering controls to prevent or limit potential exposure to hazardous substances, pollutants, or contaminants and to ensure that the remedy is effective.

Groundwater in the vicinity of OU2 is an important source of drinking water. The groundwater contamination in OU2 potentially limits the ability of numerous water rights holders to fully exercise their water rights, and it also could create a significant challenge for certain rights holders to operate their production wells in a manner that is compatible with the groundwater contamination containment goals of the OU2 Interim Remedy. The ICs for the Interim Remedy are essentially informational ICs. They include (1) annual notifications to all water rights holders in the Central Basin and other stakeholders, (2) periodic meetings with State and local agencies with jurisdiction over well drilling and groundwater use within the Central Basin, and (3) contemporaneous notifications by such agencies regarding groundwater extraction and well drilling, as described below.

The annual notification provided to all water rights holders in the Central Basin will explain the goals of the Interim Remedy, the status of the remedy's implementation, the nature and extent of OU2 groundwater contamination and the most recent available groundwater data, and discuss any related State or local restrictions and prohibitions on well-drilling and groundwater use without necessary approvals and permits.

The periodic (e.g., annual) meetings among EPA and State and local entities with jurisdiction over well drilling and groundwater use within the Central Basin would include the Watermaster; the Los Angeles County Department of Health Services (LACDHS); and the cities of Whittier, Santa Fe Springs, and Norwalk. The purpose of the meetings would be to periodically exchange all available information relevant to whether operation of any production well(s) within OU2 or its vicinity is incompatible or potentially incompatible with the groundwater contamination containment goals of the Interim Remedy. Such information would include any permit(s) for well installation that had been applied for or granted in the OU2 area or vicinity and the compatibility of such permit(s) with the RAOs of the selected OU2 remedy.

These meetings would be supplemented by an annual review of available documentation maintained by the State and local entities to determine if water supply wells have been installed, or a purveyor or other water rights holder had increased groundwater production or production capacity within OU2 or its vicinity.

Finally, the ICs include contemporaneous notification from State and local agencies with jurisdiction over well drilling and groundwater use within the Central Basin. For example, WRD could provide EPA and the entity/entities implementing the remedy with monthly pumping totals reported by water well operators. Further, LACDHS could notify EPA and such entity/ entities whenever a permit for well construction, modification or destruction has been sought. This contemporaneous notification would further reduce the possibility of contamination of OU2 area production wells and interference of well operation with plume containment goals.

If any information exchanged pursuant to the meeting or obtained through the documentation review suggested a possible incompatibility between the operation of production wells and the groundwater contamination containment goals of the selected remedy, prompt notification to EPA would be provided, if not previously provided. Thereafter, EPA would take such actions it determines are necessary or appropriate to assure that such permit or authorization does not create a risk to human health or the environment, or impair or delay any response action for the Site.

The information exchange provided by these ICs would protect public health by reducing the possibility that production wells in the vicinity of OU2 could become contaminated, and also reducing the possibility that operation of production wells would interfere with the plume containment goals of the interim OU2 remedy.

Environmental Footprint Assessment

The FS provided a preliminary assessment of the environmental footprint of the remedial alternatives, including those that make up the selected remedy. During the RD phase, the construction and operation of the groundwater extraction and treatment system will be evaluated in terms of opportunities to reduce the environmental footprint of the remedy. Detailed engineering studies will be conducted to optimize pipeline routing and design, for example, not just to reduce the initial cost of pipeline installation, but to account for energy usage (pumping power costs) associated with different pipeline materials (e.g., use smaller versus larger pipe sizes; use of smoother pipeline materials to reduce pressure losses, etc.). The design will include consideration of extensive use of lower energy-consuming equipment such as variable frequency motors with high efficiencies. As appropriate, consideration will be given to solar panels, to produce onsite power to offset facility power requirements from the local power supplier, and procurement of electrical power from alternative energy (greener) source suppliers. Emerging technologies at the time of the RD effort will be considered to minimize the environmental footprint of the selected remedy.

Performance Criteria

The performance criteria for the selected remedy are as follows: The remedial action shall provide sufficient hydraulic control laterally and vertically in the LE, CE and NE areas of the OU2 plume to prevent spreading of the plume into clean portions of the aquifers and the movement of groundwater from high concentration zones into less contaminated zones at OU2.

Compliance with the performance criterion shall be verified by demonstrating lateral and vertical hydraulic control of the plume. After the remedy has operated for a period of time, expected to last several years, compliance shall be determined by demonstrating continued hydraulic control and a decrease in COC concentrations in compliance wells over time.

To demonstrate hydraulic control, there must be evidence that the hydraulic capture zone created by the remedy encompasses OU2. The capture zone shall be estimated by measuring groundwater levels and using a groundwater flow model capable of particle tracking simulations or a similar approach. Hydraulic control shall be achieved shortly after startup of the remedy and be maintained thereafter. Implementation of the remedial action shall not result in adverse effects to water supply wells that are not part of the remedial action (e.g., no significant increase in the concentrations of COCs or significant movement of contaminated groundwater toward such wells).

The compliance locations shall be compliance monitoring wells located generally downgradient of the remedy extraction wells. Compliance wells shall be constructed to provide adequate monitoring of the remedy effects on groundwater quality.

2.12.3 Summary of the Estimated Remedy Costs

Summaries of the estimated capital, O&M, and present value costs of the major components of the selected remedy are included in Tables 7A, 7B and 8A and 8B. Tables 7A and 7B assume the treated groundwater is supplied for potable drinking water use based on Alternative 6. Tables 8A and 8B present costs for reinjection (based on Alternative 4, in which the treated water is reinjected into the deep aquifer). A detailed breakdown of these costs is provided in Appendix B of the FS. The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedy. As is the practice at federal Superfund sites, these cost estimates are based on an expected accuracy range of -30 to +50 percent of actual costs.

Table 7A. Detailed Cost Estimate for the Selected Remedy - Plumewide Extraction With Drinking Water End Use
Omega Chemical Superfund Site - OU2

Capital Costs (Plume-Wide Extraction With Drinking Water End Use)			
Major System/Component	**Quantity**	**Unit Cost**	**Cost**
CONVEYANCE & WELL SYSTEM COSTS			
Water Pipelines			
Pipelines for extracted and treated water	40,700 feet	varies	$3,230,500
Extraction Wells			
Three wells at LE Two wells at CE Two wells at NE	7	$ 276,678	$1,936,700
Monitoring Wells			
New Monitoring Wells (10 with four screened well intervals each)	10	$72,800	$1,080,600
Extraction Well Pumps/Well Heads			
New EW systems Pumps, vaults, valves, gauges, flow meters/totalizers, relief valves, power supply, etc.	7	$ 133,024	$ 931,200
TOTAL CONVEYANCE and WELL SYSTEM SUBTOTAL A			**$7,179,000**
Engineering - Design and Technical Support	8%		**$ 574,300**
Contractors Overhead, General Conditions, Mobilization/Demobilization, Temporary Facilities and Profit	~24%		**$1,737,400**
Construction Management	5%		**$ 445,800**
Construction Contingency	25%		**$2,484,100**
Conveyance and Extraction Well System Cost			**$ 12,420,600**
GROUNDWATER TREATMENT PLANT			
Untreated Water Tank			
Holding Tank (6,000 gal)	1	$35,590	$35,600
Level Switch	1	$365	$400
Treatment Plant Feed Pump			
Feed Pump(2,000 gpm @ 250 feet of head)	2	$73,365	$ 146,700
8" Flow indicating totalizer	1	$4,000	$ 4,000
Bag Filter System			
Bag Filters (2,000 gpm)	2	$20,403	$40,800
Differential pressure switch (0 to 30 psig)	1		included above
Advanced Oxidation Process (AOP)--Trojan System			
AOP System (2,000 gpm; Infl 1,4-dioxane @ 13.2 ppb to <2 ppb design; 48.5 kW reqd, use three standard 18.5-kW modules)			
--ASME code vessels	1	$54,254	$ 542,300
Peroxide Feed System	1	$80,984	$81,000
Sodium Metabisulfite Injection	1	$33,365	$33,400
Biological LGAC Adsorber System			
LGAC Adsorber Columns	2.5	$ 177,674	$ 444,200
Differential Pressure Switch (0 to 30 psig)	5	$590	$ 3,000
8-inch flow indicating totalizer	7	$4,000	$28,000
LGAC Adsorber System			

Table 7A. Detailed Cost Estimate for the Selected Remedy - Plumewide Extraction With Drinking Water End Use Omega Chemical Superfund Site - OU2			
Capital Costs (Plume-Wide Extraction With Drinking Water End Use)			
Major System/Component	**Quantity**	**Unit Cost**	**Cost**
LGAC Adsorber Column Pairs - 20,000 pounds, 10-foot diameter (One pair, 20,000 pounds, 120-inch-diameter x 144-inch SS each)	5	$ 177,674	$ 888,400
Differential Pressure Switch (0 to 30 psig)	10	$590	$ 5,900
8-inch Flow Indicating Totalizer	12	$4,000	$48,000
BW and Rinse Recovery System - 30,000 gallons	1	$ 175,164	$ 175,200
Biocide Injection System	1	$33,365	$33,400
NF Feed Tank			
Tank @ 10-minute retention time (20,000 gallons)	1	$70,691	$70,700
Level Switch	1	$365	$400
Nanofiltration System (NF)			
NF System (75 percent Recovery, 2,000 gpm)	1	$ 2,880,000	$2,880,000
--RO reject brine pump (to sewer, 500 gpm @ 60 feet of head)	2	$28,992	$58,000
-- Flow indicating totalizer	1	$4,000	$ 4,000
Chlorination System			
Holding tank, metering pumps, chlorine analyzer, mixer, etc.	1	$85,000	$85,000
Treated Water Tank			
Holding Tank (30,000 gallons) and Level Switch	1	$89,436	$89,400
Treated Water Pump			
Treated Water Pump (1,500 gpm @ 120 feet of head)	2	$52,368	$ 104,700
Flow Indicating Totalizer	1	$4,000	$ 4,000
TREATMENT PLANT Equipment Material Only "B"			**$5,806,200**
Installation (Labor for Equipment Installation)			**$1,161,200**
TREATMENT PLANT SUBTOTAL "B"			**$6,967,400**
Site Work	5.0%		$ 348,400
Mechanical Piping	15.0%		$1,045,100
I&C	10.0%		$ 696,700
Electrical	10.0%		$ 696,700
Common Facilities	8.0%		$ 557,400
Building--Office/Control Room/Lab/Restroom (Pre-Fab Office)	Lump Sum		$62,000
Metals	5.0%		$ 348,400
RO Concrete Slab and Roof Structure	2500	$ 42	$ 105,000
TREATMENT PLANT SUBTOTAL "C"			**$10,827,100**
Engineering - Design and Technical Support	8%		$ 866,200
Contractors Overhead, General Conditions, Mob/Demob, Temp Facilities and Profit	~24%		$2,620,200
Construction Management	5%		$ 672,400
Construction Contingency	25%		$3,529,900
LACSD Sewer Connection Fee	Lump Sum		$7,485,800
TOTAL TREATMENT PLANT COST			**$ 26,001,600**
GRAND TOTAL - CONVEYANCE, WELL SYSTEM AND TREATMENT PLANT CAPITAL COST			**$ 38,422,200**

Table 7A. Detailed Cost Estimate for the Selected Remedy - Plumewide Extraction With Drinking Water End Use Omega Chemical Superfund Site - OU2			
Capital Costs (Plume-Wide Extraction With Drinking Water End Use)			
Major System/Component	**Quantity**	**Unit Cost**	**Cost**

NOTES:

1. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.

2. Cost escalation adjustments from the following time periods were used, if needed, as appropriate.

Escalation Factors

2000-2009:36.02%

2003-2009: 31.61%

2004-2009: 25.74%

2005-2009: 17.72

2008-2009: 4.21%

NOTE: THESE ARE ORDER OF MAGNITUDE COST ESTIMATES, AND EXPECTED TO BE ACCURATE TO -30%/+50%.

Table 7B. Detailed Cost Estimate for the Selected Remedy - Plume-Wide Extraction With Drinking Water End Use Omega Chemical Superfund Site - OU2				
Annual O&M Costs (Plume-Wide Extraction With Drinking Water End Use)				
Equip. Name	Total Requirements	Units	Unit Cost	Cost
Electrical Power				
Extraction Wells to Treatment Plant	803,806	kW-hr		
Treatment Plant and Miscellaneous Equipment	3,016,125	kW-hr		
Total	3,819,931	kW-hr	$0.12	$ 458,400
Carbon Make-up				
LGAC (920 pounds per day)	335,800	lb C	$1.00	$ 335,800
Chemicals/Materials				
Chemicals/Materials				$ 365,400
Misc. Consumables, Sludge Disposal, Etc.				$ 76,200
Analytical				
Treatment Plant, Extraction, Monitoring Wells				$ 54,000
Labor				
Well Operating, Administrative and Management	10,200	hrs	$20 to $50	$ 439,300
Subcontracts				
Monitoring Wells Sampling (Subcontract)	1	lot	$ 90,000.00	$ 90,000
Regulatory Monitoring reports allowance (RWQCB, EPA, Air Emissions Inventory)	1	lot	$ 25,000.00	$ 25,000
Parts				
2 percent of Treatment Plant Installed Cost	2%		$10,827,251	$ 216,500
				$2,093,000
Contingency on Materials/Services	10%			$ 209,300
LACSD Annual Sewer Surcharge (annual)	1	ea	$179,097	$ 179,100
TOTAL ANNUAL O&M COSTS				**$2,481,400**
NET PRESENT VALUE OF THE ESTIMATED O&M COSTS (30 years, 7% discount rate)				**$30,791,800**
TOTAL ESTIMATED PRESENT WORTH FOR THE SELECTED REMEDY				**$69,214,000**

Table 8A. Detailed Cost Estimate for the Selected Remedy – Plumewide Extraction With Reinjection Omega Chemical Superfund Site - OU2			
Capital Costs (Plume-Wide Extraction With Reinjection)			
Component	**Quantity**	**Unit Cost**	**Cost**
CONVEYANCE & WELL SYSTEM COSTS			
Water Pipelines			
Pipelines for extracted and treated water	33,200 feet	varies	$2,511,400
Extraction			
Three Wells at LE Two Wells at CE Two Wells at NE	7	$ 276,678	$1,936,700
New Monitoring Wells			
New Monitoring Wells 10 with four screened well intervals each	10	$ 108,060	$1,080,600
Injection Wells			
Injection Wells (500 feet)	2	$ 414,196	$ 828,400
Extraction Well Pumps/Well Heads			
Pumps, vaults, valves, gauges, flow meters/totalizers, relief valves, power supply, etc.	7	$ 133,024	$ 931,200
CONVEYANCE AND WELL SYSTEM SUBTOTAL A			**$7,288,300**
Engineering - Design and Technical Support	8%		**$ 583,064**
Contractors Overhead, General Conditions, Mob/Demob, Temporary Facilities and Profit	~24%		**$1,763,769**
Construction Management	5%		**$ 452,603**
Construction Contingency	25%		**$2,521,934**
Total Conveyance and Extraction Well System Cost			**$12,609,700**
GROUNDWATER TREATMENT PLANT			
Untreated Water Tank			
Holding Tank (6,000 gallons)	1	$ 35,590	$ 35,600
Level Switch	1	$ 365	$ 400
Treatment Plant Feed Pump			
Feed Pump (2,000 gpm @ 250 feet head)	2	$ 73,365	$ 146,700
8-inch Flow Indicating Totalizer	1	$4,000	$4,000
Bag Filter System			
Bag Filters (2,000 gpm)	2	$ 20,403	$ 40,800
Differential Pressure Switch (0 to 30 psig)	1		included above
Advanced Oxidation Process (AOP)--Trojan System			
AOP System (2,000 gpm; Infl 1,4-dioxane @ 13.2 ppb to <0.05 ppb design; 143.2 kW reqd, use 8 std 18.5 kW modules)		$1,446,010	$1,446,000
Peroxide Feed System	1	$ 80,984	$ 81,000
Sodium Metabisulfite Injection	1	$ 33,365	$ 33,400
Biological LGAC Adsorber System			
LGAC Adsorber Columns (one pair, 20,000 pounds, 120-inch-diameter x 144-inch SS each)	2.5	$ 177,674	$ 444,200
Differential Pressure Switch (0 to 30 psig)	5	$ 590	$3,000
8-inch Flow Indicating Totalizer	7	$4,000	$ 28,000
LGAC Adsorber System			

Table 8A. Detailed Cost Estimate for the Selected Remedy – Plumewide Extraction With Reinjection Omega Chemical Superfund Site - OU2			
Capital Costs (Plume-Wide Extraction With Reinjection)			
Component	**Quantity**	**Unit Cost**	**Cost**
LGAC Adsorber Column Pairs, 20,000 pounds, 10-foot diameter	5	$ 177,674	$ 888,400
Differential Pressure Switch (0 to 30 psig)	10	$ 590	$5,900
8-inch Flow indicating totalizer	12	$4,000	$ 48,000
BW and Rinse Recovery System	1	$ 175,164	$ 175,200
Biocide Injection System	1	33365	33,400
RO Feed Tank			
Tank @ 10 Min. ret time (20,000 gallons)	1	$ 70,691	$ 70,700
Level Switch	1	$ 365	$ 400
Reverse Osmosis System (RO)			
RO System (75 percent Recovery, 2,000 gpm)	1	$2,880,000	$2,880,000
--RO reject brine pump (to sewer, 500 gpm @ 60 feet of head)	2	$ 28,992	$ 58,000
-- Flow indicating totalizer	1	$4,000	$4,000
Inj Well Cleaning and Water Conditioning Chemicals Injection System	1	56730	56,700
Treated Water Tank and Level Switch	1		
Holding Tank (30,000 gallons)	1	$ 89,636	$ 89,400
Treated Water Pump			
Treated Water Pump (1,500 gpm @ 25 feet of head)	2	$ 31,207	$ 62,400
Flow Indicating Totalizer	1	$4,000	$4,000
Inj Well Cartridge filters			
Cartridge Filters (2,000 gpm)	2	$ 20,403	$ 40,800
Differential Pressure Switch (0 to 30 psig)	1		included above
TREATMENT PLANT Equipment Material Only "B"			**$6,680,200**
Installation (Labor For Equipment Installation)			**$1,336,000**
TREATMENT PLANT SUBTOTAL "B"			**$8,016,200**
Site work	5.0%		$ 400,800
Mechanical Piping	15.0%		$1,202,400
I&C	10.0%		$ 801,600
Electrical	10.0%		$ 801,600
Common Facilities	8.0%		$ 641,300
Building--Office/Control Room/Lab/Restroom (Pre-Fab Office)	Lump Sum	$ 62,000	$ 62,000
Metals	5.0%		$ 400,800
RO Concrete Slab and Roof Structure	2500	$42	$ 105,000
TREATMENT PLANT SUBTOTAL "C"			**$12,431,700**
Engineering- Design and Technical Support	8%		$ 994,500
Contractors Overhead, General Conditions, Mob/Demob, Temp Facilities and Profit	~24%		$3,008,500
Construction Management	5%		$ 772,000
Construction Contingency	25%		$4,053,100
LACSD Sewer Connection Fee	Lump Sum		$7,485,800
TOTAL TREATMENT PLANT COST			**$28,745,600**
GRAND TOTAL CONVEYANCE, WELL SYSTEM AND TREATMENT PLANT COST			**$41,355,300**

Table 8A. Detailed Cost Estimate for the Selected Remedy – Plumewide Extraction With Reinjection Omega Chemical Superfund Site - OU2			
Capital Costs (Plume-Wide Extraction With Reinjection)			
Component	**Quantity**	**Unit Cost**	**Cost**

NOTES:

1. All equipment cost adjustments for size based on the formula: Adjusted Cost = Orig. Cost * (Adjusted Size/Orig. Size) EXP X where "X" is 0.33 for pumps, 0.57 for Tanks, 0.62 for towers, and 0.6 for other process equipment.

2. Cost escalation adjustments from the following time periods were used, if needed, as appropriate.

Escalation Factors

2000-2009:36.02%

2003-2009: 31.61%

2004-2009: 25.74%

2005-2009: 17.72

2008-2009: 4.21%

NOTE: THESE ARE ORDER OF MAGNITUDE COST ESTIMATES, AND EXPECTED TO BE ACCURATE TO -30%/+50%.

Table 8B. Detailed Cost Estimate for the Selected Remedy – Plumewide Extraction With Reinjection Omega Chemical Superfund Site - OU2				
Annual O&M Costs (Plume-Wide Extraction With Reinjection)				
Equip. Name	**Total Requirements**	**Units**	**Unit Cost**	**Cost**
Electrical Power				
Extraction Wells to Treatment Plant	803,806	kW-hr		
Treatment Plant and Misc. Equipment	3,372,219	kW-hr		
Total	4,176,025	kW-hr	$0.12	$ 501,100
Carbon Make-up				
LGAC (920 pounds per day)	335,800	lb C	$1.00	$ 335,800
Chemicals/Materials				
Chemicals				$ 365,400
Misc. Consumables, Sludge Disposal, Etc.				$ 76,200
Analytical				
Treatment Plant, Extraction, Monitoring Wells				$ 54,000
Labor				
Operating, Administrative, and Management	10,220	hrs	$20 to $50	$ 439,800
Subcontracts				
Monitoring Wells Sampling (Subcontract)	1	lot	$ 90,000.00	$ 90,000
Regulatory Monitoring reports allowance (RWQCB, EPA, Air Emissions Inventory)	1	lot	$ 25,000.00	$ 25,000
Parts				
2 percent of Treatment Plant Installed Cost	2%		$12,431,861	$ 248,600
				$2,168,000
Contingency on Materials/Services	10%			$ 216,800
LACSD Annual Sewer Surcharge (annual)	1		$179,097	$ 179,100
TOTAL O&M COSTS				**$2,563,900**
NET PRESENT VALUE OF THE ESTIMATED O&M COSTS (30 years, 7% discount rate)				**$31,815,500**
TOTAL ESTIMATED PRESENT WORTH				**$73,170,800**

2.12.4 Expected Outcomes of the Selected Remedy

The selected remedy will protect human health and environment by preventing further spreading of the contaminated groundwater to as yet uncontaminated portions of the aquifer and nearby production wells. A plume-wide extraction system will provide a high degree of confidence in achieving complete plume capture and will greatly impede the spread of contamination from high to lower concentration zones at OU2. Treatment plant influent concentrations are expected to decrease over time as contaminated groundwater is removed. The remedy will start protecting downgradient areas shortly after startup.

Although restoration of the aquifer is not an objective of this remedy, the remedy will begin the process of restoring the contaminated aquifer by removing contaminants from the groundwater. The remedy will reduce the eventual cost, difficulty and time required for restoration of the aquifer.

Compliance with plume containment objectives shall be verified by demonstrating hydraulic control of the OU2 groundwater plume. The remedial action shall provide sufficient hydraulic control to prevent lateral and vertical spreading of COCs in groundwater at OU2 to protect current and future uses of groundwater; and to prevent lateral and vertical migration of groundwater with high concentrations of COCs into zones with currently lower concentrations of COCs to optimize the treatment of extracted groundwater. To evaluate compliance with those objectives, the remedy includes a monitoring program that will provide data to determine if the remedy is achieving hydraulic control. Compliance with EPA's objectives will also be evaluated with measured groundwater levels and groundwater modeling coupled with analytical results from wells within the plume and downgradient of the plume. The monitoring program including monitoring wells and sampling/analytical requirements will be developed during remedial design.

Performance standards for treated groundwater are summarized in Table 9 based on drinking water end use. The current regulatory standards for TCE, PCE, and the other VOC COCs are the state and federal MCLs. However, for the drinking water end use, the water will be treated to lower levels to the extent required by the CDPH through the 97-005 permit process.

The current regulatory standard for total chromium (including hexavalent chromium) in drinking water is the State MCL of 50 μg/L. There is no Federal or State MCL for hexavalent chromium, although the State has recently adopted a Public Health Goal for hexavalent chromium of 0.02 μg/L. This level, however, is below the current CDPH detection limit for purposes of reporting of 1 μg/L and is also not achievable by existing treatment technologies for drinking water. The finalization of the PHG is expected to lead to the adoption of an MCL within 3-4 years. In the interim, CDPH has noted that a treatment standard of 5 μg/L is within the limits achievable by existing treatment technologies. The OU2 FS assumed the use of a treatment technology for hexavalent chromium that could achieve achieve an effluent level of 5 μg/L.

No state or federal MCL has been promulgated for 1,4-dioxane. EPA is therefore using the CDPH notification level, which is a health-based advisory level for drinking water use, as the performance standard for treatment of extracted groundwater in OU2. Notification levels are established by CDPH as precautionary measures for contaminants that may be considered candidates for establishment of MCLs. Although the OU2 FS was based on the then-current NL of 3 μg/L for 1,4-dioxane, the NL has recently been reduced to 1 μg/L. This change will increase the cost estimate for the selected remedy relative to the estimate in the FS for Alternative 6, but the cost increase is relatively small.

Compliance with plume containment objectives for the end use of reinjection is the same as that described above for the preferred drinking water end use. However, the performance standards for treated groundwater for the reinjection end use, presented in Table 10, are different than for drinking water end use.

Table 9. Performance Standards for Treatment of Extracted Groundwater for Drinking Water End Use Omega Chemical Superfund Site – OU2		
Contaminant of Concern	**Basis for Performance Standard**	**Performance Standard[a]**
TCE`	Federal MCL	5 µg/L
PCE	Federal MCL	5 µg/L
1,1-DCA	Federal MCL	5 µg/L
1,2-DCA	Federal MCL	0.5 µgL
1,1-DCE	Federal MCL	6 µg/L
cis-1,2-DCE	Federal MCL	6 µg/L
1,1,2-TCA	Federal MCL	5 µg/L
Bis(2-Ethylhexyl)phthalate	California MCL	4 µg/L
Aluminum	Federal MCL	50 µg/L
Manganese	Federal MCL	50 µg/L
Total Chromium	California MCL	50 µg/L
Hexavalent Chromium	See footnote “c”	50 [b,c] µg/L
Nitrate (as Nitrogen)	Federal MCL	10 mg/L
Sulfate	California MCL	250 mg/L
TDS	Federal MCL	500 mg/L
1,4-dioxane	CDPH notification level	1 µg/L
Perchlorate	California MCL	6 µg/L
Carbon Tetrachloride	California MCL	0.5 µg/L

Notes:

Additional contaminants not listed above may be included by CDPH in the 97-005 permit.

[a]The CDPH may require lower concentrations in the treated effluent as a result of the 97-005 permit process.

[b]Federal and State MCLs for hexavalent chromium have not been established; therefore, the State MCL for total chromium (50 µg/L) is the current regulatory standard applied to hexavalent chromium in drinking water.

[c]A public health goal (PHG) for hexavalent chromium of 0.02 µg/L has recently been adopted by OEHHA. It is expected that a State MCL for hexavalent chromium will be adopted in 3-4 years. In the interim, CDPH has noted that a treatment standard of 5 µg/L is within the capabilities of existing treatment technologies.

Table 10. Performance Standards in Treated Groundwater for Reinjection End Use Omega Chemical Superfund Site – OU2		
Contaminant of Concern	**Basis for Performance Standard[d]**	**Performance Standard[a] (µg/L)**
TCE	Federal MCL/State Antidegredation Policy	TBD
PCE	Federal MCL/State Antidegredation Policy	TBD
1,1-DCA	Federal MCL/State Antidegredation Policy	TBD
1,2-DCA	Federal MCL/State Antidegredation Policy	TBD
1,1-DCE	Federal MCL/State Antidegredation Policy	TBD
cis-1,2-DCE	Federal MCL/State Antidegredation Policy	TBD
1,1,2-TCA	Federal MCL/State Antidegredation Policy	TBD
Bis(2-Ethylhexyl)phthalate	California MCL/State Antidegredation Policy	TBD
Aluminum	Federal MCL/State Antidegredation Policy	TBD
Mn	Federal MCL/State Antidegredation Policy	TBD
Selenium	Federal MCL/State Antidegredation Policy	TBD
Total Chromium[b]	California MCL/State Antidegredation Policy	TBD
Hexavalent Chromium[c]	See footnote “c” /State Antidegredation Policy	TBD
Nitrate (as Nitrogen)	Federal MCL/State Antidegredation Policy	TBD
Sulfate	California MCL/State Antidegredation Policy	TBD
TDS	Federal MCL/State Antidegredation Policy	TBD
1,4-dioxane	CDPH notification level/State Antidegredation Policy	TBD
Perchlorate	California MCL/State Antidegredation Policy	TBD
Carbon Tetrachloride	California MCL/State Antidegredation Policy	TBD

Notes:

[a] Performance standards for reinjection water for the COCs listed are TBD (To Be Determined) and must be addressed in the future RD phase consistent wtih statewide aquifer anti-degradation policies recognizing that the aquifer at the point of reinjection will need to be fully characterized. Consequently, it is possible that additional contaminants may require treatment to ND levels if they are not present in the aquifer where reinjection is to occur.

[b]Total chromium is mostly hexavalent chromium.

[c]A PHG for hexavalent chromium has recently been adopted by OEHHA. It is expected that a State MCL for hexavalent chromium will be adopted within 3-4 years.

[d] The basis for a performance standard will be (at a minimum) MCLs (Federal or State) in the scenario when a specific constituent is already at levels higher than MCLs in the aquifer. The basis of performance standard will be the California State antidegradation policy (SWRCB Resolution 68-16) in the scenario in which a given constituent is 1) present at lower levels than the MCL, or, 2) if it is not present in the aquifer (e.g., at ND levels). In the first scenario, reinjected water must be treated in a manner consistent with Basin Plan requirements. In the second scenario, specific constituents must be treated to ND levels before reinjection.

2.12.5 Applicable or Relevant and Appropriate Requirements

The selected remedy is expected to comply with all federal and State ARARs. Because this remedy is an interim action that does not include restoration of the aquifer as an objective, EPA is not, at this time, establishing chemical-specific ARARs as in situ cleanup goals for contaminated groundwater at the Site. In situ cleanup goals will be addressed in a subsequent decision document. Federal and State drinking water standards are relevant and appropriate to water extracted from the aquifer and delivered to one or more potable water purveyors for use as drinking water. All extracted and treated water that is delivered to water purveyors is expected to comply with MCLs.

2.13 Statutory Determinations

Under CERCLA Section 121, EPA must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), consider the reasonableness of cost for the selected remedy, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ, as a principal element, treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous wastes and a bias against offsite disposal of untreated wastes. The following sections discuss how the selected remedy meets these statutory requirements.

2.13.1 Protection of Human Health and the Environment

The selected remedy will reduce human health risk by limiting the spread of contaminated groundwater into clean portions of the aquifer and into less contaminated portions of groundwater within the plume itself, reducing the likelihood and, potentially, the magnitude of human exposure to contaminated groundwater. The remedy targets groundwater in higher contamination areas within the plume (CE and NE areas) and also captures the plume at the leading edge.

If no action is taken, contaminated groundwater will continue to spread, increasing the likelihood of future increases in contaminant concentrations in downgradient portions of the aquifer, and increasing the eventual cost, difficulty, and time required for restoration of the aquifer.

The selected remedy includes aboveground treatment systems to remove the COCs from the extracted groundwater. After treatment, the extracted groundwater will achieve all ARARS identified in this ROD. The remedy also requires compliance with ARARs associated with the disposal of treatment residuals, if any, to eliminate or minimize short-term risks and cross-media impacts. The remedy includes an extensive monitoring program to evaluate the effectiveness of the remedy.

At present, there is no known exposure pathway in which ecological receptors could be exposed to contaminated groundwater at the Site.

2.13.2 Compliance with ARARs

The selected remedy shall comply with ARARs as described as follows. A complete list of all ARARs for the selected remedy is provided in Tables 11 to 13. Table 14 summarizes to-be-considered (TBC) material.

Section 300.430(e)(2)(i)(A) of the NCP requires that the contaminant levels of the groundwater that remains in the aquifer are reduced below MCLs. Because this remedy is an interim action that does not include restoration of the aquifer as an objective, EPA is not, at this time, establishing chemical-specific ARARs as in situ cleanup goals for contaminated groundwater at the Site. In situ cleanup goals will be addressed in a subsequent decision document. All extracted and treated water that is provided as drinking water is expected to comply with MCL ARARs.

The ARARs are frozen at the time the ROD is signed, but off-site requirements, including requirements applicable to treated water delivered to the drinking water supply, must be met in order to comply with the selected remedy's selected end use regardless of whether those requirements change over time. As a result, if an offsite drinking water requirement changes, the treatment system must meet whichever standard—the performance standard selected in the ROD or the offsite requirement—is lower.

Table 11. Potential Chemical-Specific Applicable or Relevant and Appropriate Requirements Omega Chemical Corporation Superfund Site - OU2				
Requirements	**Description**	**Media**	**Applicable or Relevant and Appropriate**	**Findings and Comments**
Federal Primary Drinking Water Standards Federal Safe Drinking Water Act (SDWA), 42 USC §300 *et seq.* 40 CFR Part 141.61 and 40 CFR 141.62	The SDWA establishes Federal primary drinking water standards, including MCLs to protect the quality of water in public drinking water systems. MCLs are enforceable standards and represent the maximum contaminant concentrations permissible in a public water system.	Groundwater	Relevant and appropriate	The Interim Remedy will result in the use of treated groundwater as drinking water supply or for aquifer replenishment. In either case, water treatment systems will reduce the concentrations of COCs to below EPA or State MCLs, whichever is lower. MCLs are considered relevant and appropriate for the purpose of establisihing performance standards for treated groundwater.
California Toxics Rule 40 CFR 131.36(d)(10)(ii)	The California Toxics Rule is a federal regulation promulgated under the federal Clean Water Act that sets numeric criteria for certain pollutants in inland waters. It applies to waters assigned an aquatic life or human health use classification in a California Regional Water Quality Control Plan.	Groundwater	Applicable	Criteria will be applicable if there are temporary discharges of surface water during operation of the Interim Remedy.
State of California Domestic Water Quality and Monitoring Regulations Health and Safety Code (H&S Code) §4010 *et seq.* 22 California Code of Regulations (CCR) §64431 and 64444	Establishes California MCLs. Some California MCLs are more stringent than the federal MCLs, and some California MCLs are established chemicals for which there are no federal MCLs. The more stringent limit is determined on a chemical-by-chemical basis.	Groundwater	Relevant and appropriate	State MCLs that are more stringent than federal MCLs are ARARs for the purpose of establishing performance standards for COCs in the water extracted from the aquifer and treated at the groundwater treatment plant. The State MCLs for perchlorate (for which no federal MCL exists) and for carbon tetrachloride and Total Chromium (which are lower than the federal MCLs) are relevant and appropriate to the Interim Remedy.
Water Quality Control Plan (Basin Plan) for Los Angeles Region (adopted 06/13/94), Chapters 2 and 3	The California Porter-Cologne Water Quality Act incorporates the requirements of the federal Clean Water Act (CWA) and implements additional standards and requirements for surface waters and groundwaters of the state. Pursuant to California Water Code §13240 et seq., the Regional Water Quality Control Board, Los Angeles Region, formulates and enforces water quality standards defined in the Basin Plan. The Basin Plan (Chapters 2 and 3) establishes beneficial uses of ground and surface waters; establishes water quality objectives (WQOs), including narrative and numerical standards; establishes implementation plans to meet WQOs and protect beneficial uses, and incorporates Statewide Water Quality Control Plans and policies. The WQOs for groundwater are based on the primary MCLs.	Groundwater	Relevant and appropriate	The provisions of Chapters 2 and 3 of the Basin Plan that establish beneficial uses of ground and surface waters; establish water quality objectives (WQOs), including narrative and numerical standards; establish implementation plans to meet WQOs and protect beneficial uses; and incorporate Statewide Water Quality Control Plans and policies are relevant and appropriate to the Interim Remedy. Water extracted from the aquifer will be treated to achieve MCLs, which are identified in the Basin Plan as a WQO for groundwater.

Table 12. Potential Action-Specific Applicable or Relevant and Appropriate Requirements
Omega Chemical Corporation Superfund Site – OU2

Requirements	Description	Media	Applicable or Relevant and Appropriate	Findings and Comments
Storm Water Discharge Requirements 40 CFR §122.26	Nonpoint sources must be addressed using best management practices (BMPs) to control contaminants in stormwater runoff from construction activities. The SWRCB has established requirements for general construction activities, including clearing, grading, excavation reconstruction, and dredge and fill activities. Regulates pollutants in stormwater discharge from hazardous waste treatment plants, landfills, land application sites, and spent dumps.	Groundwater	Applicable	If construction of the groundwater treatment plant disturbs 1 acre or more of soil, compliance with substantive aspects of the General Permit for Storm Water Discharges Associated with Construction or Land Disturbance Activity (Order No. 2009-0009-DWQ, NPDES No. CAS000002) is required.
SWRCB Resolution 68-16 (Statement of Policy with Respect to Maintaining High Quality of Waters in California)	SWRCB Resolution No. 68-16 requires maintenance of existing state water quality using best practicable treatment technology unless a demonstrated change will benefit the people of California, will not unreasonably affect present or potential uses, and will not result in water quality less than that prescribed in other state policies. In no case may Basin WQOs be exceeded.	Groundwater	Applicable	Applies to the discharge of waste to waters, including groundwater reinjection. Implementation of the Interim Remedy will protect existing groundwater quality by containing contamination within the OU2 plume, and will not preclude the final remedy from maintaining the existing quality of background water.
Sources of Drinking Water SWRCB Resolution No. 88-63	This policy specifies that ground and surface waters of the State are considered to be suitable or potentially suitable for municipal or domestic water supply (MUN designation) subject to limited exceptions. If the water is designation as MUN beneficial use, then it must meet the requirements of the Water Quality Control Plan (i.e., the Basin Plan).	Groundwater	Applicable	The requirement is applicable because groundwater underlying the Site meets the criteria as a potential source for drinking water. Water extracted from the aquifer will be treated to achieve MCLs, which are identified in the Basin Plan as a WQO for groundwater. Thus, extracted water will be reduced to levels protective of beneficial uses.
Identification and Listing of Hazardous Waste 22 CCR §66260.200 (Classification of a Waste as Hazardous or Nonhazardous) 22 CCR Div. 4.5, Chap. 11 (§66261.1 et seq.) (Identification and Listing of Hazardous Waste) 22 CCR §66264.13 (General Waste Analysis)	A waste generator must determine if the waste is classified as a hazardous waste in accordance with the substantive criteria and methodology provided in these requirements. Some of the Site waste may meet the characteristics of hazardous waste.	Soil and groundwater	Applicable	Influent groundwater and waste generated during construction of the Interim Remedy and operation of the groundwater treatment plant will be evaluated, characterized, and managed in accordance with substantive provisions of these requirements.

Table 12. Potential Action-Specific Applicable or Relevant and Appropriate Requirements Omega Chemical Corporation Superfund Site – OU2				
Requirements	**Description**	**Media**	**Applicable or Relevant and Appropriate**	**Findings and Comments**
Standards Applicable to Generators of Hazardous Waste, 22 CCR Div. 4.5, Chap. 12		Soil and groundwater		
22 CCR §66262.10	22 CCR 66262.10 lists the sections of California law with which a generator of hazardous waste must comply.		Applicable	The Interim Remedy need only comply with the substantive provisions of the regulations listed in 22 CCR 66262.10.
22 CCR §66262.11	22 CCR 66262.11 Requires waste generators to determine if wastes are hazardous, and establishes procedures for such determinations.		Applicable	The substantive requirements of 22 CCR 66262.11 will be applicable to management of waste materials generated by the groundwater treatment plant and to any waste generated while installing new wells.
22 CCR 66262.34(a)(1)(A)	Waste stored on-Site will be placed in containers or tanks that are in compliance with California Hazardous Waste Regulations.		Relevant & appropriate	Wastes generated during construction of the Interim Remedy and operation of the groundwater treatment plant will be managed in accordance with the requirements of 22 CCR Div. 4.5, Chap. 12. Storage of hazardous waste accumulated on-Site must be in compliance with substantive requirements prior to offsite disposal. An EPA Region 9-approved CERCLA disposal facility must be used to dispose of CERCLA waste.
Requirements for Hazardous Waste Accumulation				
Preparedness and Prevention 22 CCR Div. 4.5, Chap. 15, Art. 3 (§66265.30 et seq.)	Facility design and operation to minimize potential fire, explosion, or unauthorized release of hazardous waste.	Soil and groundwater	Applicable	The groundwater treatment plant will be designed and operated in a manner that minimizes the potential for fire, explosion, or unauthorized release of hazardous waste.
Use and Management of Containers; Tank Systems 22 CCR Div. 4.5, Chap. 15, Art. 9, 10 (§66265.170 et seq.; §66265.190 et seq.)	Regulates use and management of containers, compatibility of wastes with containers, and special requirements for certain wastes. Maintain hazardous waste in containers and dispose to a Class I hazardous waste disposal facility within 90 days. These requirements may apply for the storage of soil cuttings, contaminated groundwater, and sediments trapped by the bag filter during startup operation.	Soil and groundwater	Applicable	Hazardous waste generated during construction of the Interim Remedy and operation of the groundwater treatment plant will be managed in accordance with 22 CCR Div. 4.5, Chap. 15, Art. 9, including accumulation in appropriate DOT -specification containers that are in good condition and kept closed except when adding or removing waste, and inspected on a weekly basis. Waste will not be kept onsite for more than 90 days.

Table 12. Potential Action-Specific Applicable or Relevant and Appropriate Requirements Omega Chemical Corporation Superfund Site – OU2				
Requirements	**Description**	**Media**	**Applicable or Relevant and Appropriate**	**Findings and Comments**
California Land Disposal Restrictions, Requirements for Generators 22 CCR Div. 4.5, Chap. 18, Art. 2, 4, 5, 10 & 11	Compliance with land disposal regulation standards is required if hazardous waste (e.g. contaminated soil) is placed on land.	Soil	Applicable	Land disposal requirements may apply to the disposal of spent carbon generated during the treatment of groundwater for VOCs and, potentially, to the disposal of treatment residuals associated with other technologies if the wastes are determined to be hazardous wastes. Wastes will be characterized before shipment offsite to determine whether land disposal restriction treatment standards apply and, if so, whether the waste meets the treatment standards.
Clean Air Act, South Coast Air Quality Management District (SCAQMD) Rules and Regulations Regulation IV, Rule 401, Visible Emissions Regulation IV, Rule 402, Nuisance Regulation IV, Rule 403, Fugitive Dust Regulation XIII, Rules 1301 through 1313, New Source Review Regulation XIV, Rules 1401 and 1401.1, New Source of Toxic Air Contaminants.	The SCAQMD regulations are established to achieve and maintain state and federal ambient air quality standards through the federal-approved state implementation plan (SIP). SCAQMD Rule 401 limits visible emissions from a point source and provides air quality standards that may not be exceeded. SCAQMD Rule 402 prohibits discharge of material that is odorous or causes injury, nuisance, or annoyance to the public. SCAQMD Rule 403 limits downwind particulate concentrations. SCAQMD Rules 1301 through 1313 establish new source review requirements. Rule 1303 requires that all new sources of air pollution in the air district use best available control technology (BACT) and meet appropriate offset requirements. Emission offsets are required for all new sources that emit more than 1 pound per day of VOCs. SCAQMD Rule 1401 requires that best available control technology for toxics (T-BACT) be employed for new stationary operating equipment if the cumulative carcinogenic impact from air toxics would exceed the maximum individual cancer risk limit of 1 in 1 million (1×10^{-6}) without T-BACT. SCAQMD Rule 1401.1 applies to discharges that are within 500 feet of a school and requires that the discharges from the facility do not create a cancer risk in excess of 1 in 1 million (1×10^{-6}) at the school.	Air	Applicable	Construction and operational activities must comply with all substantive applicable SCAQMD requirements. If air stripping is used to remove VOCs from groundwater, air emissions must meet substantive applicable SCAQMD requirements.

Table 12. Potential Action-Specific Applicable or Relevant and Appropriate Requirements Omega Chemical Corporation Superfund Site – OU2				
Requirements	**Description**	**Media**	**Applicable or Relevant and Appropriate**	**Findings and Comments**
Publicly Owned Treatment Works (POTW) Requirements	Treated effluent discharge to reclaimed water line and brine discharge to sanitary sewer must comply with any requirements set forth by the current POTW owner, LACSD.	Groundwater	Applicable	The groundwater treatment plant will be constructed and operated in a manner that complies with requirements established by the POTW.

Table 13. Potential Location-Specific Applicable or Relevant and Appropriate Requirements Omega Chemical Corporation Superfund Site – OU2				
Requirements	**Description**	**Media**	**Applicable or Relevant and Appropriate**	**Findings and Comments**
National Historic Preservation Act 16 USC §470 et seq. 36 CFR §60.4	The requirements establish a National Register and Advisory Council on Historic Preservation. Remedial activities that would affect a property on or eligible for the National Register are required to consult with the Advisory Council and the State Historic Preservation Officer. Surveys that may be required will result in the determination of adverse effects and the development of mitigation reports. Historic sites that would be affected by potential remedial activity at this location may be identified on or adjacent to the Site.	Soil and groundwater	Applicable	Construction of extraction wells, piping, and the central groundwater treatment plant are not expected to occur at any locations identified as historic sites or structures; no areas within the Site have been designated as having historic value to warrant inclusion in the National Register. EPA will evaluate whether any site or structure encountered during implementation of the remedy is eligible.

Table 14. To-Be-Considered Criteria Omega Chemical Corporation Superfund Site – OU2			
Requirements	**Description**	**Media**	**Findings and Comments**
California Notification Levels (NLs)	NLs are health-based advisory levels established by the California Department of Public Health (CDPH) for contaminants that lack primary MCLs. NLs are advisory levels and not enforceable standards. An NL is the level of a contaminant in drinking water that, if not exceeded, is considered to not pose a significant health risk to people ingesting that water on a daily basis. For 1,4-dioxane, a chemical considered a probable carcinogen and a COC at the Site, the NL is generally a level considered to pose "de minimis" risk (that is, a theoretical lifetime increase in risk of up to one excess case of cancer in a population of 1,000,000 people—the 10E-6 risk level). Table 2-1 provides the NL for 1,4-dioxane.	Groundwater	In the absence of an MCL, the CDPH notification level for 1,4-dioxane has been considered during selection of performance standards for extracted groundwater.
CDPH Policy Guidance for Direct Domestic Use of Extremely Impaired Sources (Policy Memo 97-005)	This policy establishes a process, including permitting, that must be followed before using an "extremely impaired water source" as a drinking water supply. This policy is not a promulgated requirement (i.e., not promulgated under federal or State law), and therefore is not an ARAR.	Groundwater	Administrative and substantive requirements of Policy Memo 97-005 must be followed by any water purveyor seeking to use treated OU2 groundwater in its water supply system, if the use of the water occurs off-Site. If the use of water occurs on-Site, only substantive requirements of Policy Memo 97-005 are required to be followed. Policy Memo 97-005 will be considered during design and operation of the treatment system, including establishing performance standards, failure response triggers, and operator qualifications.
California Well Standards CDWR Bulletin 74-81 CDWR Bulletin 74-90	CDWR Bulletin 74-81 (domestic water well standards) and supplemental Bulletin 74-90 provide minimum specifications for monitoring wells, extractions wells, injection wells, exploratory borings, and cathodic protection wells. Design and construction specifications are provided for construction and destruction of wells and borings.	Soil and groundwater	Substantive provisions of the California well standards will be considered when designing and installing groundwater extraction wells.

Notes:

DOT = California Department of Transportation

POTW = Publicly Owned Treatment Works

T-BACT = Best Available Control Technology for Toxics

VOC = volatile organic compound

WDR = waste discharge requirements

WQO = water quality objectives

The selected remedy shall comply with all ARARs described in this section. Because this is an interim action for containment of groundwater contamination, EPA has not established chemical-specific ARARs as in-situ cleanup levels for restoration of the aquifer.

The remedial actions selected in this ROD may trigger additional legal requirements. These requirements are not identified as ARARs in this ROD either because such requirements do not meet the definitional prerequisites (as established by CERCLA Section 121(d)(2)) to be identified as an ARAR for onsite activities, or because such requirements are triggered by offsite activities. For example, the General Pretreatment Regulations for Existing and New Sources of Pollution, 40 CFR §403 *et seq*., apply to brine discharge from the groundwater treatment plant to the POTW. Effluent discharged to sanitary sewers and POTWs are regulated by municipalities through the NPDES Program. Discharges to an offsite wastewater treatment facility must meet pretreatment requirements established by the POTW.

2.13.3 Cost-Effectiveness

In EPA's judgment, the selected remedy is cost effective. Section 300.430(f)(ii)(D) of the NCP requires EPA to evaluate the cost of an alternative relative to its overall effectiveness. This was accomplished by evaluating "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., Alternatives 3 through 6, which are protective of human health and comply with all selected ARARs). Overall effectiveness was evaluated by assessing four of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; short-term effectiveness; and implementability). Overall effectiveness was then compared to costs to determine cost effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence this alternative represents a reasonable value for the money spent.

The estimated NPV of the selected remedy (Alternative 6 as modified) is $69-73 million, depending on the end use of the water. Although Alternative 2 has the lowest NPV cost of $54 million, it does not meet the plume capture and containment criterion. All the other action Alternatives 3, 4, and 5 have equal or higher NPV costs ($86 million, $73 million, and $83 million, respectively) while providing the same degree of plume capture and containment (or less in the case of Alternative 3) as the selected remedy.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at OU2, until EPA obtains sufficient data to select a final remedy. EPA has also determined that the selected remedy provides the best balance of tradeoffs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against offsite treatment and disposal, as outlined as follows:

- Long-term Effectiveness and Permanence: By controlling (to the extent practicable) migration of the groundwater exceeding MCLs, including the most highly contaminated groundwater in the OU2 plume, the area for potential future residual contamination in groundwater is limited.

- Reduction of Toxicity, Mobility, or Volume through Treatment: Hydraulic containment and groundwater treatment will reduce the mobility and volume of dissolved-phase VOC and other contaminant concentrations in groundwater and result in the permanent destruction of VOCs and 1,4-dioxane.
- Short-term Effectiveness: There are no special short-term effectiveness issues that set the selected remedy apart from the other alternatives evaluated.
- Implementability: The selected remedy is not more complex to implement than the other remedial alternatives.

2.13.5 Preference for Treatment as a Principal Element

The selected remedy will treat VOCs and other contaminants in the extracted groundwater to achieve the performance standards. By using treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

2.13.6 Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 Documentation of Significant Changes

The Proposed Plan for OU2 was released for public comment in August 2010. It identified, as EPA's preferred alternative, the groundwater extraction, treatment, conveyance, and monitoring facilities and institutional controls included in Alternative 6. It identified drinking water as the end use.

EPA reviewed all written and verbal comments submitted during the public comment period (August 23, 2010 to November 22, 2010). Multiple parties commented on the drinking water end use, including the assertion that Alternative 6 would be difficult to implement; that it will be time-consuming for parties to reach agreement on several aspects of the remedy; and that a plan is needed to address potential delays of implementing the remedy. Consequently, EPA is memorializing in this ROD the alternate end use option of reinjection into the aquifer. As noted in this ROD, if EPA determines that agreement(s) necessary for implementation of Alternative 6 (drinking water end use) cannot be reached in a timely manner, EPA may approve reinjection as an alternate end use option.

In the selected remedy, reinjection is not limited to the deep aquifer as it was in Alternative 4. However, regardless of the depth at which it occurs, reinjection must be implemented in a manner that does not cause interference with containment of the plume and does not result in further spreading of existing plumes in the shallow or deep aquifer.

EPA's responses to comments on its proposed cleanup plan are included in the Responsiveness Summary, which is Part 3 of this ROD.

Part 3
Responsiveness Summary

Part 3 - Responsiveness Summary

The purpose of this Responsiveness Summary is to provide a summary of EPA's responses to comments received from stakeholders and the public on EPA's Proposed Plan for the Omega Chemical Corporation Superfund Site Interim Groundwater Remedy for Operable Unit 2 (OU2). EPA held a public meeting on August 31, 2010, at which EPA representatives presented the Proposed Plan and answered questions about the Site and the preferred remedial alternative from various individuals, including representatives of water purveyors. Comments made on the preferred alternative were later included in formal comment letters submitted during the public comment period on the Proposed Plan (August 23, 2010 to November 22, 2010). The transcript for the public meeting is part of the Administrative Record file at the information repositories identified in the ROD and below.

Golden State Water Company (GSWC) requested a 30-day extension of the initial public comment period (to September 21, 2010), which EPA granted. Thereafter, two additional stakeholders (Congresswoman Grace Napolitano and the Southeast Water Coalition) requested an additional 30-day extension, which EPA also granted, extending the public review period through November 22, 2010.

During the public comment period, EPA received letters from 14 stakeholders and one local consultant with comments on the Proposed Plan. Comments were received from the following: Anthony Martinez (local consultant), California Department of Public Health (CDPH), Central Basin Municipal Water District (CBMWD), City of Lakewood, City of Norwalk, City of Santa Fe Springs, Golden State Water Company (GSWC), Los Angeles County Department of Public Works (LADPW), McKesson Corporation, Omega Chemical Site PRP Organized Group (OPOG), Phibro-Tech, Inc. (PTI), Southeast Water Coalition, T3W Business Solutions, Inc., and the Water Replenishment District of Southern California (WRD). All of the comment letters are included in the Administrative Record.

In this Responsiveness Summary, EPA is required to consider and address comments that are pertinent and significant to the remedial action being selected. EPA is not required to address comments that pertain to the allocation of liability for the remedial action, nor potential future enforcement actions to implement the remedial action, as these are distinct from the selection of the remedial action. EPA may address comments with limited pertinence if doing so would address a concern of a significant segment of the public.

A summary of the major issues raised by commenters is presented in the next section.

3.1 Stakeholder Issues

During the 90-day public comment period, the community response to EPA's Proposed Plan was limited to a newspaper article (*Whittier Daily News*, November 11, 2010, by M. Sprague), several questions about the location of the plume relative to residential homes, and questions from property owners regarding their potential liability. In addition, EPA received a letter of comment from a local consultant.

A summary of all comments and EPA's response to those comments is provided in Appendix A. This summary includes comments requesting modifications of the remedy, additional investigations, or other actions by EPA. Many of the comment letters also contained opinions, explanations, and general statements. Where similar comments were submitted, the comments have been summarized by category to avoid repetition. The names of the commenters are listed in parenthesis after the comment. A detailed response to the comments is provided in bold italics in Appendix A.

3.2 Technical and Legal Issues

The main technical and legal issues raised in the comments include the following:

- **Several parties commented that the remedy should be implemented immediately to protect drinking water wells.**
  EPA agrees that it is highly important to initiate the selected interim remedy (Alternative 6) (occasionally referred to herein as the Interim Remedy or Selected Remedy) to contain the OU2 plume as quickly as possible. EPA is pursuing an interim remedy at this time because it can be selected and implemented in a more timely manner than a full final cleanup remedy. The overall objective of the Interim Remedy is to protect human health and the environment by preventing further spreading of the contaminated groundwater.

- **Several parties commented that Alternative 6 may be difficult to implement, and that it may require extensive effort and time to reach agreements with a water purveyor to accept the treated water, negotiate water rights in this adjudicated water basin, and address water replenishment fees. There was also concern that complying with the California Department of Public Health Policy Memo 97-005 (Policy Guidance for Direct Domestic Use of Extremely Impaired Sources) (CDPH 97-005), which establishes a series of review and approval steps to be followed before an extremely impaired water source can be used as a drinking water, could also be a lengthy process.**
  EPA acknowledges there may be significant challenges involved in these steps towards implementation of the Interim Remedy. EPA has included flexibility in the ROD that allows discharge of treated water via reinjection if EPA determines the required agreement(s) for drinking water end use cannot be reached in a timely manner. As described in the FS, reinjection would have to be implemented in a manner that does not cause interference with containment of the plume and does not result in further spreading of existing plumes in the shallow aquifer.

- **Several parties commented that the depth of the plume, especially near the leading edge, may be greater than what was determined in the RI/FS.**
  Information collected to date continues to indicate that the majority of the contaminant mass is in the shallow aquifer, with some increase in VOC concentrations occurring in the deeper wells. Prior to construction of the Interim Remedy, additional investigation of the aquifers will be performed to support the remedial design (RD) and ensure the extraction wells are properly placed to capture the lateral and vertical extent of the known

plume. EPA will continue to work collaboratively with WRD and United States Geological Survey (USGS) to gather and share existing data, to assist in characterizing the deep aquifers.

- **Several parties commented that the proposed remedy does not include source control for facilities that are located in the OU2 plume area.**
  EPA agrees that the interim remedy will not address individual source areas, most of which are being addressed by the State of California (through the Department of Toxic Substances Control (DTSC) or the Regional Water Quality Control Board (RWQCB)). The RI addresses several confirmed and potential source areas within the footprint of the OU2 plume. EPA has selected an interim remedy to achieve a timely containment of the commingled plume. Following implementation of the interim remedy for OU2, EPA will conduct further studies and expects to propose additional remedial actions for the OU2 plume as part of the final cleanup remedy for the Site. As part of those studies, EPA will work with the State to identify and address all significant sources within the OU2 plume area that have contributed to the groundwater contamination. Most of the known sources are currently being addressed by State-led actions. EPA expects that the rest of the sources will be addressed by the combined efforts of the State and EPA.

A detailed response to the comments received is included in Appendix A.

Appendix A: Detailed Response to Comments

The comments have been categorized into the following four main categories:

1. Table I: Comments Related to the Contaminated Groundwater Plume
2. Table II: Comments Related to the Selected Interim Remedy
3. Table III: Comments Related to Permitting and Compliance
4. Table IV. Other Comments

Table I: Comments Related to the Contaminated Groundwater Plume

1. The Proposed Plan is based on 2007 data and the plume is moving about 500 feet per year; consequently, the leading edge now may be close to Interstate 5. The plume may have migrated beyond the planned extraction locations presented in the Proposed Plan. The current proposed extraction well locations may not capture the plume. The plume location using more recent (2010) data is requested. (City of Norwalk, City of Santa Fe Springs, WRD, T3W Business Solutions, Inc., and GSWC)

   Response: EPA acknowledges that the Proposed Plan was based on the 2007 groundwater data in the RI/FS reports. The 2007 data comprised the most current and complete data set available at the time the FS was being prepared. EPA and other parties have continued to collect additional groundwater data since the RI/FS was completed, and EPA expects that the additional data will be used during the design process to ensure that the extraction wells are placed to meet the containment goals of the selected remedy.

   EPA continues to monitor the groundwater at OU2 biannually and has considered the more recent (2008 - 2010) groundwater monitoring data in preparing this ROD. EPA does not believe that these data suggest the need for any change in the basic elements of EPA's selected interim remedy. The more recent analytical results support the importance of containing the plume to prevent further spreading of the contaminated groundwater. The 2008-2010 data indicate an increase in VOC concentrations in the downgradient wells near the leading edge of the plume and also in the deeper wells. The increase in VOC concentrations at the leading edge wells indicates the plume has expanded laterally. The increase in VOC concentrations in the deeper wells may indicate that contamination migrates downward near the plume's leading edge. Although the concentrations are higher, the overall lateral extent of the plume has not changed substantially from 2007 to 2009. Plume maps have been updated to reflect the new data. The plume of contaminated groundwater does not appear to have reached Interstate 5.

   During the remedial design phase, the specific locations, depths and pumping rates of the extraction wells will be designed to ensure capture of the known plume. Specific pumping rates will be further evaluated during remedial design to maximize their effectiveness and optimize their efficiency.

Table I: Comments Related to the Contaminated Groundwater Plume

2. The RI identifies a horizontal plume at OU2; it does not account for a "plunging plume" and vertical gradients into the deeper aquifer, and so does not accurately describe the vertical plume extent. The plume is expected to plunge and contaminate the deeper aquifer, and contaminants will not remain at shallow depths. New EPA monitoring wells should be installed deeper than 300 feet to delineate the current leading edge and depth extent of the plume. (WRD) ***Response: EPA agrees that the contaminated groundwater plume may migrate to deeper aquifer units. The RI/FS concluded that there is a potential for downward migration of contaminants at OU2 and the plume is expected to expand vertically.*** ***EPA investigations characterized the vertical extent of contamination. Monitoring wells were installed at depths up to 200 feet. At the time of installation, VOCs were not detected in the deepest wells, and the vertical extent of the plume appeared to be fully characterized. There are some hydrogeologic features (anticlinal structure and fine-grained units) that would restrict downward migration in the center of the plume. However, near the leading edge of the plume, the downward sloping (dipping) aquifer units are expected to facilitate downward migration of the contamination. Information collected to date continues to indicate that the majority of the contaminant mass is in the shallow aquifer, with some increase in VOC concentrations occurring in the deeper wells. Recent data does indicate some downward movement of the contamination. Declining water levels have been observed throughout OU2 and this may be a contributing factor to the downward movement of the contamination.*** ***The classic "plunging plume" effect that is recognized by hydrogeologists is caused by infiltration atop an advancing plume and its displacement downward. This is not expected to be significant in this Central Basin area where groundwater flow is primarily driven by production pumping and infiltration at the spreading basins, which are located outside of the OU2 area, along the San Gabriel River. Infiltration in the OU2 area is low, with rainfall and irrigation accounting for a small fraction of the water budget. One objective of the selected interim remedy is to contain the lateral and vertical migration of the contaminated groundwater plume. This will limit the downward migration of the contamination. EPA has continued to conduct biannual groundwater monitoring, and we agree that further investigations of the deeper aquifer units at OU2, including the installation of additional deep monitoring wells, will be necessary.***
3. Deeper extraction wells (below 300 feet) may be necessary to control the plume. (WRD) ***Response: Based on information collected to date, most of the contaminant mass at OU2 is expected to be in the shallow aquifer. EPA agrees that details regarding the depths and approach to deepening the extraction wells should be further evaluated. Additional studies will be conducted during remedial design to ensure the extraction wells are properly designed to achieve the containment goals of the selected remedy.***

Table I: Comments Related to the Contaminated Groundwater Plume

4. The Golden State Water Company's (GSWC) Pioneer and Dace wells should be shown within the OU2 boundaries. The contamination currently found in these GSWC wells is likely from OU2 based on compounds detected, TCE/PCE ratios, and dates when contamination was first detected. OU2 fails to meet the National Contingency Plan (NCP) criteria for defining an Operable Unit since it does not encompass the impacted GSWC wells. EPA states that GSWC wells have been impacted by the Omega plume. (WRD & GSWC)

   Response: The RI/FS states that the GSWC wells are "likely" impacted by the OU2 plume, meaning that at least some of the contamination found in the Pioneer and Dace wells is likely coming from the OU2 plume.

   In addition, the wells are likely extracting contamination from other sources in the area as well (i.e., sources outside of the OU2 plume). The well network in this area is not intended to fully characterize sources other than those contributing to the OU2 plume. The GSWC wells could be capturing contamination from sources west or south of OU2. Historical data show that GSWC first detected contamination in these wells in the early 1980's when contamination from the former Omega Chemical Corporation could not have migrated to this area. The former Omega Chemical facility began operating in 1976 and is located more than four miles away. It is extremely unlikely that the plume could have migrated that distance in that short period of time.

   It is likely that the contamination impacting the GSWC wells has originated from multiple sources (some from the OU2 plume and some from other non-OU2 sources). EPA will extend the OU2 boundary to include these GSWC wells if additional investigations (e.g., during RD) confirm plume continuity in this area.

5. The plume of contaminated groundwater may have migrated beyond the GSWC wells. Additional investigation is needed around the GSWC Pioneer and Dace wells to assess the possibility that contamination is being drawn downward by the GSWC wells but not captured and moving farther downgradient. (WRD & Anthony Martinez)

   Response: EPA agrees that the contamination may be drawn downward by the GSWC wells and that the plume may have migrated past some of the GSWC well locations. EPA continues to gather data and information on contamination in the OU2 area and at the leading edge of OU2 plume near other GSWC well locations. Because VOC contamination is present throughout the Central Basin, the presence of VOCs at the GSWC wells does not necessarily mean that the OU2 plume extends to these wells. EPA has sufficient data to move forward with an interim containment remedy to prevent the contamination from spreading to areas not currently impacted and to prevent impacts to other production wells down gradient. The specific locations of the extraction wells for the interim containment remedy will be determined during the design phase of the project and will be located to ensure full capture of the known OU2 plume. After implementation of the interim remedy, EPA will continue to conduct studies and collect additional information to assist in the future selection of a final

Table I: Comments Related to the Contaminated Groundwater Plume

remedy. If further studies confirm that the OU2 plume extends to these GSWC wells, EPA will extend the OU2 boundary as appropriate.
6. The characterization of the downgradient western and southern portions of the plume is based on relatively few sampling points, especially at depths greater than 150 feet. (Anthony Martinez) ***Response: EPA agrees that there is limited data on groundwater contamination at the southern (or leading edge) of the plume. During the design of the selected remedy, additional data will be gathered to assist in selecting the specific extraction well locations to ensure they are placed to adequately contain the known plume. EPA also agrees that more investigation of the deep aquifer is necessary.***
7. Contamination from the former Omega facility could not have migrated a distance of 4.5 miles. EPA's repeated attribution of the entire geographic extent of the OU2 plume to contaminant releases from the Omega property is factually inaccurate. (OPOG) ***Response: EPA disagrees with this statement. EPA has collected and evaluated extensive data on conditions in the OU2 area, conducted extensive groundwater modeling and concluded that contamination from the former Omega facility could have migrated 4.5 miles downgradient in the period since that facility began operations. The contamination at OU2 has advanced at an apparent plume expansion rate of at least 540 feet per year; this rate is an estimated minimum rate and includes the combined effects of advection, sorption, dispersion, and degradation. This plume expansion rate is consistent with estimates of advective velocity of 620 feet per year. The operations at Omega Chemical began in 1976, and contamination from that facility could have easily migrated a distance of 4.5 miles in the years since then.***

Table I: Comments Related to the Contaminated Groundwater Plume

8. EPA has not included the identified sources of contamination as participants in the remedy. OPOG has identified additional sources of contamination. A number of facilities have used Freon including the former Cal Air facility at 12484 E. Whittier Blvd., McKesson, Eastman Kodak, and Chrysler Nu-Car Prep. Site L from EPA's RI is clearly a source of Freon releases to the subsurface. The extent of the 1,4-dioxane plume from the Omega property is approximately one mile. (OPOG)

Response: The purpose of the ROD is to select the appropriate remedy for achieving the Remedial Action Objectives (RAOs), which are to (1) prevent unacceptable human exposure to groundwater contaminated by contaminants of concern (COCs); (2) prevent lateral and vertical spreading of COCs in groundwater at OU2 to protect current and future uses of groundwater; and (3) prevent lateral and vertical migration of groundwater with high concentrations of COCs into zones with currently lower concentrations of COCs to optimize the treatment of extracted groundwater. In addition, the Interim Remedy is expected to begin the process of restoring the contaminated aquifer by removing contaminant mass from the groundwater.

The ROD does make any determinations as to who is liable for and should implement the selected remedy. EPA's RI Report identified* numerous confirmed and potential *sources of contamination in the OU2 area. EPA intends to request the participation of known sources in implementation of the selected interim remedy for OU2. EPA has been and remains willing to consider information about other sources of contamination in the OU2 area.

Following implementation of the interim remedy for OU2, EPA will conduct further studies and expects to propose additional remedial actions for the OU2 plume as part of the final cleanup remedy for the Site. Any potentially responsible parties (PRPs) identified pursuant to further investigations would be expected to participate in implementation of Site cleanup actions.

In addition, EPA will continue to work with the State to identify all significant sources within the OU2 plume area that have contributed to the groundwater contamination. Most of the known sources are currently being addressed by State-led actions. EPA expects that any additional facilities confirmed as sources of contamination to the OU2 plume will be addressed through the coordinated efforts of the State and EPA.

EPA's interpretation of the OU2 data indicates the 1,4-dioxane plume is approximately 4.5 miles long and continuous across OU2. The extent of the 1,4-dioxane plume is based on collected field data and it is consistent with the extent of the solvent (e.g., PCE and TCE) and Freon plumes from the Omega property.

Table I: Comments Related to the Contaminated Groundwater Plume

9. Recent investigation results indicate that Phibro-Tech, Inc. is not a contributor of VOCs or hexavalent chromium to the Omega OU2 groundwater plume. (Phibro-Tech, Inc.)

Response: The purpose of the ROD is to select the appropriate remedy for achieving the Remedial Action Objectives (RAOs). The ROD does make any determinations as to who is liable for and should implement the selected remedy. EPA has determined that the Phibro-Tech, Inc. facility contributed to groundwater contamination in the OU2 area. The reports prepared by Phibro-Tech, Inc.'s consultants and state agencies document the use of VOCs, chromium, and other chemicals at the facility. They also document historical releases of these compounds into the subsurface, and contamination found in soil, soil gas, and groundwater beneath the facility. While EPA will continue to review the information that Phibro-Tech, Inc. recently (February 2011) provided, this information would not affect selection of the interim containment remedy.

Table II: Comments Related to the Selected Interim Remedy

10. A contingency plan is needed to address potential delays of implementing the remedy. (City of Norwalk & WRD) ***Response: EPA understands that the drinking water end use option will require the participation and cooperation of one or more local water utilities in order to be successfully implemented, and that the role of those utilities may need to be memorialized in negotiated agreements that address, among other things, operational, liability, financial and water rights issues. EPA has included flexibility in the ROD that allows discharge of treated water via reinjection if EPA determines the required agreement(s) for drinking water end use cannot be reached in a timely manner. As described in the FS, reinjection would have to be implemented in a manner that does not cause interference with containment of the plume and does not result in further spreading of existing plumes in the shallow aquifer.***
11. Drinking water use will not be acceptable to the residents without additional educational outreach by EPA and an aggressive campaign promoting treated water quality beyond drinking water standards. (City of Norwalk & City of Santa Fe Springs) ***Response: EPA is aware of the need for a public outreach and education program to ensure residents are aware of the safeguards and oversight that will be a part of the remedy to guarantee that the treated water meets or exceeds the drinking water standards. EPA will work with stakeholders to develop the scope and content of a communications plan that includes public outreach through facts sheets, news releases, and meetings.***
12. Recommendation for a combination of Alternatives 4 (reinjection of treated groundwater) and 5 (discharge of treated groundwater to spreading basins) rather than a single end use Alternative 6 (drinking water end use). A combination of Alternatives 4 and 5 will benefit the region as a whole and allow for continuous pumping necessary to achieve containment. A hybrid of Alternatives 4, 5, and 6 with multiple end uses may provide a more comprehensive benefit to the region as a whole rather than a single end use of treated drinking water. Alternative 6 would be more difficult to implement than a combination of Alternative 4 and 5 that can be implemented more quickly and without adverse local reaction to using treated water for drinking water. (City of Norwalk, City of Santa Fe Springs and Southeast Water Coalition) ***Response: After consideration of stakeholders' comments, EPA has selected a remedy that best meets all the nine remedy evaluation criteria in the NCP. While none of the alternatives presented in the RI/FS are without limitations or challenges, EPA believes that Alternative 6 is the best approach to achieving the RAOs in a cost-effective manner. EPA has included flexibility in the ROD that allows discharge of treated water via reinjection if EPA determines the required agreement(s) for drinking water end use cannot be reached in a timely manner. As described in the FS, reinjection would have to be implemented in a manner that does not cause interference with containment of***

the plume and does not result in further spreading of existing plumes in the shallow aquifer. ***Alternative 5 would result in interrupted operation of the extraction wells (and thus the containment system) due to the periodic maintenance of the spreading basins; consequently, there would be reduced control over implementation of the remedy (i.e., operating times and extraction rates). Alternative 5 also had a higher cost than Alternatives 4 or 6. Including a combination of two or three end uses, as suggested, would substantially increase the remedy cost.***
13. WRD supports EPA's alternatives except for Alternative 5: Discharge to the spreading basins. This could interfere with current replenishment operations and would not allow continuous extraction. (WRD) ***Response: Comment noted. EPA agrees that Alternative 5 is not the best option for achieving the goals of the remedy.***
14. EPA relies on the GSWC wells pumping to control the lateral migration of the plume. Alternative 6 depends on continuing extraction from GSWC wells. The GSWC wells are an integral part of the remedy and the remedy effectiveness would be affected should these wells reduce or cease pumping. The remedy is relying on GSWC wells to capture and treat contaminants in groundwater. (WRD & GSWC) ***Response: The selected containment remedy does not rely on the operation of the GSWC wells to control migration of the OU2 plume. In fact, the FS notes the plume-wide extraction well network (which is part of the selected remedy) would perform more efficiently, and could operate at lower extraction rates and lower cost, if the GSWC Pioneer and Dace wells were to stop pumping.*** ***EPA has not asked GSWC to stop operating these wells, and the selected remedy assumes that these wells will keep extracting groundwater. Should the GSWC wells cease pumping, the remedy will still perform as intended.*** ***EPA expects that groundwater pumping by various parties in and near the OU2 area (including those parties implementing the selected remedy) will need to be coordinated to ensure that neither adversely affects the other. The institutional controls (ICs) selected as part of the remedy will help ensure coordination between EPA and State and local entities with jurisdiction over well drilling and entities with jurisdiction over groundwater use within the Central Basin. The ICs will also help ensure there is communication and coordination between those that hold rights to extract groundwater, and this will reduce the possibility that operation of the GSWC production wells would interfere with the plume containment goals of the interim OU2 remedy.***

Table II: Comments Related to the Selected Interim Remedy

15. The remedy is not sufficiently protective because it does not provide treatment for contaminants that may reach the GSWC wells. The remedy does not address the treatment of contaminants, such as 1,4-dioxane, which the current GSWC wellhead treatment units cannot treat. (WRD & GSWC) ***Response: The selected remedy includes treatment of 1,4-dioxane in the extracted groundwater, and the ROD allows flexibility to select the most appropriate treatment technology for 1,4-dioxane during the remedial design process. ~~EPA Disagrees.~~ The purpose of the selected containment remedy is to keep the contaminated groundwater plume from spreading, and to protect production wells such as the GSWC wells from being further degraded by the migration of contaminated groundwater that would otherwise occur. Without the interim remedy, groundwater with high concentrations of VOCs and 1,4-dioxane would reach the GSWC wells. EPA notes that 1,4-dioxane is already present in the GSWC wells and other production wells in the area west of OU2, indicating widespread contamination.***
16. Alternative 5 (discharge of treated groundwater to spreading basins) is the most appropriate remedy and it provides added protection to residents. If the treatment system fails under Alternative 6, contaminated water could be distributed to the public water supply. (Anthony Martinez) ***Response: EPA does not agree that Alternative 5 would be more protective of human health. The treated water produced by the selected remedy will meet state and federal drinking water standards and comply with all the monitoring, testing and other requirements for public drinking water systems. It will include the appropriate safeguards (e.g., redundant treatment units for key contaminants and storage prior to distribution) to ensure that contaminated groundwater is never allowed to enter the distribution system. The treatment system details will be further evaluated and refined during the remedial design effort. The design and operation of the treatment plant will comply with the same stringent requirements as other drinking water systems. The treatment technologies are well developed and have been used at other Superfund sites where remedies provide treated water for use in municipal water supply systems.***
17. Section 2.5.4 of the FS indicates that hydraulic barriers have not been considered in the technology screening process and the selection of the preferred remedy. This technology could be employed at the leading edge of the plume of contaminated groundwater. A hydraulic barrier would eliminate the need for leading edge extraction wells, which would reduce the flow of treated contaminated groundwater to the drinking water system. A numerical model must be used to design the shape and pumping rates of a barrier that would be effective, and determine if such a barrier would be feasible. A hydraulic barrier has these advantages: • Injecting the treated water near the toe of the plume would reverse the flow gradient and contaminants from the down gradient portion of the plume would be pulled toward

the extraction systems in the central portion of the plume. The operational period of the pump-and-treat system and the overall cost of the remedy could be reduced.

- By eliminating the need for leading edge extraction wells, the cost of the piping from the leading edge extraction wells to the centrally located treatment plant could be eliminated.
- By reducing the flow to the treatment plant from about 2000 gallons per minute to about 1300 gallons per minute, the cost of the treatment plant would be reduced by a factor of approximately 75%-80%.

(T3W Business Solutions, Inc.)

Response: The purpose of the remedy is to contain the groundwater plume and keep the contaminants from spreading. If water were to be re-injected into the shallow aquifer, it could mobilize contamination within and outside OU2 and interfere with the RAOs, and could also affect and interfere with remedial actions at other source areas within or near OU2. EPA has included flexibility in the ROD for the discharge of treated water via reinjection, but such reinjection will have to be implemented in a manner that does not cause interference with containment of the plume and does not result in further spreading of existing plumes in the shallow aquifer. EPA does not agree that implementing the remedy in the manner suggested in this comment would necessarily be any more cost-effective than operating extraction wells at the leading edge of the plume. EPA does not agree that a 35% reduction in extraction rate would result in remedy cost reduction by 75%-80% as suggested.

18. Thermal oxidation is a technology retained in the FS for future consideration in the remedial design. Thermal oxidation should not be retained for consideration for the Site, because constituents of concern include chlorinated volatile organic compounds. Thermal oxidation, when used to treat vapors containing chlorinated compounds, has the potential to emit dioxin, a highly toxic carcinogen for which there is no known safe emission level. (T3W Business Solutions, Inc.)

    Response: EPA agrees that the off-gas from an air-stripper will contain chlorinated compounds. EPA is aware of the potential for the generation of dioxins and other unwanted compounds (such as chloric acid) during thermal oxidation of chlorinated hydrocarbon vapors. However, thermal oxidizers can be built and operated in a controlled way to prevent dioxin formation. Final selection of the specific groundwater treatment systems will be conducted during the RD phase and will be designed to ensure the remedy is not creating secondary health risks.

Table II: Comments Related to the Selected Interim Remedy

19. Alternative 4 (reinjection of treated groundwater) is preferable to Alternative 6 because:
    - The risk of contaminating the drinking water supply if there is an upset in the proposed groundwater treatment plant would be eliminated.
    - Risk would be shifted away from the operator of the public drinking water supply system to the operator of the remedy.
    - The operator of the groundwater treatment system would be economically incentivized to maintain excellent quality control/quality assurance procedures for operations and maintenance of the treatment plant.
    - There are also potential benefits to other stakeholders if a hydraulic barrier is included in the remedy design, and treated water is injected north of the hydraulic barrier. These include:
        - Reduction of environmental risk because injection would be into a groundwater gradient moving toward the extraction wells. The economic penalty for injecting inadequately treated water would essentially be for prolonging the operation and maintenance period of the remedy, not for contaminating uncontaminated regions of the aquifer.
        - Reduction of overall cost of the remedy.
        - Shortening the operational period of the remedy.

    (T3W Business Solutions, Inc.)

    Response: Based on EPA's experience with similar groundwater remedies with drinking water end use, the Selected Remedy can be implemented safely and without any significant risk of contamination of the drinking water system. Treated water under the Selected Remedy will meet all state and federal drinking water standards.

    In addition, the selected remedy will have to satisfy the CDPH requirements for treatment and monitoring of water from an impaired source.

    EPA has selected Alternative 6 (Treated water used as drinking water) because it presents the most reasonable and cost-effective remedial approach to achieve containment of the OU2 plume and meets all state and federal drinking water standards. EPA has included flexibility in the ROD that the discharge of treated water via reinjection could be implemented if agreements with water purveyors cannot be negotiated in a timely manner.

    The ROD is not intended to fully formulate the details of the design of the selected remedy. This will be accomplished during the RD process.

    There do not appear to be any suitable locations for injection upgradient of OU2. Furthermore, upgradient injection would require higher extraction rates and additional pipelines, resulting in increased costs.

Table II: Comments Related to the Selected Interim Remedy

The Selected Remedy is an interim remedy, not a final remedy; the duration of its operation of 30 years was selected for cost estimating purposes. A containment remedy without source control would have to operate indefinitely, with or without reinjection. Source control will be an integral part of the anticipated final remedy for the site. When the final remedy is selected, the remedy lifetime and cost will be considered in the selection.
20. McKesson offers an Alternate Remedy that would: • Eliminate the Leading-edge (LE) Extraction wells; and • Move the Central Extraction (CE) wells approximately ½ mile farther south to more effectively capture higher concentrations of constituents of concern (COCs) that, under EPA's Proposed Plan Remedy, would not be captured by the interim remedy wells and would ultimately be captured by the Pioneer Public Supply Wells (Pioneer Wells); and • Reduce the total groundwater extraction rate from 1,300 gallons per minute (gpm) to 800 gpm, with approximately equal extraction rates of 400 gpm from the CE and Northern Extraction (NE) wells; and • Reinject the treated groundwater into the shallow aquifer from which it was extracted, rather than delivering it as drinking water. (McKesson**)** ***Response: This proposed alternative would not meet all of EPA's RAOs. Elimination of the leading edge extraction would allow known contamination to migrate towards GSWC's production wells. Moving the CE area wells as suggested would allow groundwater contaminated with PCE and TCE concentrations exceeding 100 µg/L (twenty times the drinking water standard) to continue to spread downgradient. Reinjection into the shallow aquifer could mobilize other contaminant plumes, such as the plume at the former CENCO refinery, and have the net effect of creating more contamination in the groundwater plume.*** ***The LE, CE, and NE locations were identified as general extraction locations needed to achieve containment of the plume, with the CE and NE wells also serving to keep the higher concentrations of contaminants from moving into less contaminated areas. The LE wells will keep the known lower levels of contamination at the leading edge from migrating further downgradient and protect production wells that are located in that area downgradient of the plume. The actual extraction locations will be optimized during the remedial design to ensure that the extraction wells are placed to achieve effective containment of the highly contaminated groundwater.*** ***EPA's Selected Remedy meets the objectives of the remedy which are to contain the OU2 plume.***

Table II: Comments Related to the Selected Interim Remedy

21. The LE wells are unnecessary, inefficient and should be eliminated. The need for containment at the toe of the plume has not been demonstrated. Extraction at the toe of the plume would be expensive and may not be necessary due to the low contaminant concentrations and grossly overstated plume migration rates. Existing production wells could be utilized to clean up the low level contamination and this would reduce costs.

    (McKesson & OPOG)

    Response: ***EPA disagrees that the leading edge wells are unnecessary, and also disagrees that the plume migration rates have been overstated. EPA's analysis concluded that the plume expansion rate is approximately 540 feet/year and found this estimate to be reasonable. Extraction at the leading edge of the plume is necessary to protect public water supplies. The leading edge extraction will keep known contamination from migrating further downgradient and protect production wells that are located in that area downgradient of the plume.***

    The existing production wells are not suitable for the purposes of containment of the plume. They are constructed with generally deep screens and would draw contaminated groundwater into deeper portions of the aquifer. The production wells are also located generally too far from the plume edge and would allow for lateral plume expansion. Finally, the production wells may not completely capture the plume, allowing it to bypass them and migrate farther downgradient.

22. The proposal to deliver the treated water as drinking water would unnecessarily increase the risk to the public, will cost more than estimated, and may be infeasible. (McKesson)

    Response: EPA disagrees that there is added risk to the public, and believes the cost estimates are reasonable and that implementation is feasible. The treated water will meet all Federal and State drinking water standards before it is delivered to a water purveyor. EPA has noted the inherent uncertainties regarding cost at the time of issuance of a ROD. The cost estimates have an expected accuracy of +50% to -30%, which applies to all of the alternatives evaluated.

Table II: Comments Related to the Selected Interim Remedy

23. EPA is willing to sacrifice GSWC wells to Omega contamination. These wells are already intercepting the plume. EPA is not providing an interim protection of GSWC wells. (GSWC) ***Response: EPA disagrees with the characterization that it is "sacrificing" GSWC's wells to the contamination from the former Omega Chemical Corporation facility. One objective of the selected remedy is to prevent further spreading of the contaminated groundwater. GSWC first detected contamination in its wells nearly three decades ago when contamination from the former Omega facility could not have migrated to this area. It is likely that the contamination impacting the GSWC wells has originated from multiple sources. GSWC added wellhead treatment systems to several of its wells in 1996 and 1999 to ensure state and federal drinking water standards would be met. Those systems continue to be in operation.*** ***The selected interim remedy will prevent the highly contaminated groundwater in the center of the plume (upgradient from GSWC wells) from being drawn down and into the GSWC wells. It will also prevent further spreading of the contaminated groundwater to uncontaminated portions of the aquifer and other nearby production wells.***
24. There is no analysis in the RI/FS of possible effects of the remedy pumping on the groundwater supply and GSWC's ability to produce water. (GSWC) ***Response: EPA conducted computer modeling of groundwater flow in and around the OU2 area during the RI/FS, and that evaluation indicated there will be no significant depletion of groundwater in the OU2 area for a remedy pumping at a rate of 2,000 gpm. It is within GSWC's rights to continue pumping water from the affected Pioneer and Dace wells, or to shift production to another area to avoid treatment costs.***
25. The recommended remedy fails to comply with ARARs. The FS fails to address key ARARs, such as: the Public Health Goal (PHG) for hexavalent chromium proposed by the Office of Environmental Health Hazard Assessment; CDPH Policy 97-005; State Water Resources Control Board (State Board) Resolutions 68-16 and 92-49; RWQCB (Los Angeles Region)'s authority over discharge of brine to an ocean outfall; and requirements of the California Public Utilities Commission (CPUC), which regulates GSWC. For 1,4-dioxane, EPA recently lowered the 10^{-6} cancer risk level from 1 ppb to 0.35 ppb, which could prompt CDPH to correspondingly lower the notification level (NL); the proposed remedy aims to reduce the concentrations to 2 ppb in order to comply with the current CDPH NL of 3 ppb. (GSWC) ***Response: EPA believes the selected remedy will comply with all ARARs and to-be-considered (TBC) criteria, and will achieve the other performance standards identified in the ROD, including the latest CDPH notification level for 1,4-dioxane, which was established after the Proposed Plan was finalized. A number of the items cited by the commenter are not ARARs but will be considered during the remedial design process.***

Table II: Comments Related to the Selected Interim Remedy

The remedy also may accommodate any new or modified requirements that come into effect prior to and during RD as the specific details of the remedy are developed, if those requirements call into question the protectiveness of the remedy. . If the State ultimately promulgates an MCL for hexavalent chromium that is lower than the performance standard in the ROD, and the protectiveness of the remedy is called into question, the remedy will be re-evaluated at that time, and treatment changed if necessary to ensure that the treated water continues to meet all drinking water standards. ***The following are specific responses to the ARARs issues raised in the comment:*** ***In July 2011, the State adopted a final PHG for hexavalent chromium of 0.02 µg/L (0.02 ppb). However, a PHG is not a regulatory standard and is not an ARAR. According to State law, CDPH must now develop and adopt an MCL for hexavalent chromium. That process is expected to take 3-4 years, and in the interim CDPH has suggested using 5 µg/L as a placeholder for the performance standard, as it is within the capabilities of existing treatment technologies for hexavalent chromium. If the MCL adopted by CDPH is lower the level required in the 97-005 permit, EPA will re-evaluate the remedy and change the performance standard as needed to ensure that treated water provided as drinking water continues to meet all drinking water standards.*** ***Although it is a policy and has not been promulgated under Federal or State law – and therefore is not an ARAR for the selected interim remedy -- the process set forth by CDPH Policy 97-005 will need to be undertaken and Policy 97-005's requirements met if the treated water is used in the municipal water supply. Policy 97-005 has been included as a TBC item in the ROD (Table 14).*** ***State Board Resolution 92-49 is not an ARAR for the selected interim remedy. Its only substantive requirement for purposes of ARARs analysis (i.e., Section III.G) applies where cleanup goals based on background concentrations cannot be attained due to technological and economic limitations. Because the proposed remedy is considered interim, EPA is not setting in situ numeric cleanup goals for the OU2 groundwater at this time.*** ***State Board Resolution 68-16 is identified as an ARAR in the ROD.*** ***The CPUC regulations cited by GSWC are not identified as ARARs for the selected interim remedy. EPA recognizes the CPUC's authority pursuant to the California Constitution and State statute, as also reflected by California case law. Compliance with the Federal and State primary drinking water standards (MCLs) identified as ARARs in the ROD will constitute compliance with the CPUC's rules.*** ***The RWQCB Los Angeles Region regulates discharges of treated groundwater. The brine resulting from the interim remedy's treatment process would be discharged to a nearby industrial sewer line for disposal pursuant to a sewer use permit from LACSD. No additional permit is needed for this discharge.***

Table II: Comments Related to the Selected Interim Remedy

26. The FS does not analyze all impacts to the GSWC wells, such as increasing treatment costs, and the need for institutional controls (ICs). (GSWC) ***Response: The FS evaluates and discusses certain potential impacts to GSWC's wells, as well as the need for institutional controls, which eventually were selected as part of the OU2 remedy (see, e.g., FS sections 2.5.2 and 3.2.1). ICs will consist of annual reviews, notifications and meetings.*** ***The FS does not evaluate impacts to GSWC wells such as increasing treatment costs. The objectives of the FS were to (1) develop and evaluate remedial alternatives that mitigate threats to human health and the environment from the continued spread of contaminated groundwater at OU2 and (2) identify a preferred alternative to present in the Proposed Plan. EPA believes sufficient data were available to achieve the objectives of the FS.*** ***Although EPA recognizes there may be additional impacts (e.g., financial) to GSWC's wells, resulting from contamination at the former Omega Chemical Corporation facility and other sources contributing contamination to the OU2 plume, these impacts are beyond the scope of the selection of the interim remedy for OU2.***
27. The FS does not provide sufficient explanation of the actual technical and administrative implementability of the CDPH 97-005 process, biological treatment process, and disposal of brine. (GSWC) ***Response: The treatment processes outlined in the FS all have demonstrated technical and administrative implementability (for example, many have been used in other Superfund remedies that provide treated water for use in drinking systems). In order for the treated water to be served as drinking water (the selected end use), the process set forth by CDPH and delineated in its Policy 97-005 will need to be undertaken and the Policy 97-005 requirements met. The specific details of the treatment processes and other system requirements related to public water supplies will be developed through meetings and coordination with CDPH during the RD phase of the project. A nonconsumptive water use exemption will be sought from WRD for the disposal of the brine.***

Table II: Comments Related to the Selected Interim Remedy

28. EPA did not evaluate or consider additional facilities that are potential sources of contaminants to the plume. The absence of adequate source control throughout the footprint of the Regional plume is a fatal flaw to the success of the selected remedy. The pump and treat remedy will be ineffective and costly without source control for all contamination sources at OU2. State agencies may not address the sources under their oversight in a reasonable timeframe, given the State's financial situation. (OPOG)

    Response: EPA recognizes the importance of source controls for successful long-term remediation, but is not seeking to address all the potential sources in this interim remedy, the objectives of which are focused on containment of the OU2 plume. EPA does not believe that the lack of source control on all facilities is a fatal flaw, as the selected remedy is capable of adequately treating the existing contaminant plume. In addition, there will be a groundwater monitoring network to evaluate changes in the plume and provide adequate lead time to modify the treatment system as necessary. EPA will continue coordination with and, if needed, provide assistance to, the State agencies responsible for oversight of these facilities to ensure that cleanup efforts are undertaken in a timely manner. In addition, EPA will work with the State to identify and address all significant sources within the OU2 plume area that have contributed to the groundwater contamination. Most of the known sources are currently being addressed by State-led actions. EPA expects that the rest of the sources will be addressed by the combined efforts of the State and EPA.

29. EPA has not adequately evaluated whether water purveyors will accept the treated water. (OPOG)

    Response: EPA had initial discussions with purveyors who expressed preliminary interest in accepting the water. If necessary, EPA will facilitate future negotiations between the parties responsible for implementing the remedy, the water purveyors, and other stakeholders. EPA recognizes that it may be difficult and time-consuming for an agreement to be reached. EPA has included reinjection in the selected remedy as an alternative for disposal of treated water in part to address the uncertainty regarding securing necessary agreement(s) among stakeholders for drinking water end use in a timely manner.

Table III: Comments Related to Permitting and Compliance

30. Discharge to Los Angeles County Flood Control District (LACFCD) under Alternative 5 will require a Flood Permit and verification of coverage and/or exemption under an applicable National Pollutant Discharge Elimination System Permit (NPDES). The water quality would need to meet surface water standards. A spreading agreement would need to be developed, including indemnity clauses and payments for discharges. (LADPW) ***Response: Comment noted. EPA did not select Alternative 5 as the OU2 interim remedy.***
31. The City of Norwalk is concerned about the aesthetics of the remedy and its impacts on the area. All City permitting requirements should be followed. (City of Norwalk) ***Response: EPA appreciates the City's concerns regarding the aesthetics and impacts of the interim remedy and will work with the City during implementation of the interim remedy to address those concerns. There will be compliance with all substantive aspects of City permitting requirements for actions occurring on-Site and within City limits.***
32. The drinking water end use by a public water system will be subject to CDPH Policy Memo 97-005 which requires more stringent treatment than presented in the FS, for example for hexavalent chromium. (CDPH) ***Response: EPA is aware of these requirements and expects that design of the remedy will comply with Policy 97-005 to assure that the necessary treatment is provided and all other requirements are met.***

Table IV: Other Comments

33. Request that EPA make Omega a Fund-Lead project, given the urgency to construct the remedy to prevent further plume expansion. (City of Norwalk, City of Lakewood, and Southeast Water Coalition) ***Response: EPA's policy is to pursue "enforcement first" throughout the Superfund cleanup process, which promotes the "polluter pays" principle and helps to conserve the resources of the Hazardous Substance Trust Fund for the cleanup of those sites where viable responsible parties do not exist. See "Enforcement First for Remedial Action at Superfund Sites" policy, September 20, 2002. A major component of the "enforcement first" policy is that potentially responsible parties should conduct remedial actions wherever possible. Consistent with this policy, EPA will first seek to negotiate a timely settlement with the PRPs for implementation of the interim remedy. If an agreement is not achieved in a timely manner, EPA will evaluate its other options, which include making the Site a Fund-lead project.***
34. EPA has no plan for keeping PRPs engaged to hold them responsible for 30 years. The ROD should state the role the PRPs are to engage in, and also state the time frame of their responsibility until the plume is completely cleaned up. (City of Santa Fe Springs) ***Response: CERCLA provides EPA with various mechanisms and broad authority for keeping potentially responsible parties "engaged" in remedy implementation over the long term (e.g., consent decrees and unilateral orders with provisions for long-term implementation). The Agency has been very successful in using those mechanisms to ensure that PRPs implement cleanups, and EPA will make every effort to ensure that this occurs for the OU2 remedy.***
35. Issuing a ROD claiming to use Santa Fe Springs's Reservoir No. 1 as a mixing tank is premature without understanding the City's system operation. (City of Santa Fe Springs) ***Response: The Selected Remedy includes drinking water end use but does not specify any municipal water system to be used, nor how any components of a system, such as Reservoir #1, would be used. In the FS, Alternative 6 includes treatment of extracted water to meet Federal and State drinking water standards, and Reservoir No. 1 is identified as a potential location for the delivery of the treated water. EPA recognizes that any such use of a reservoir would be subject to agreements negotiated between the water utility and the party or parties responsible for implementing the remedy. A final decision on the delivery location will be made during the RD and may include other water purveyors as well.***

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36. The Santa Fe Springs well No. 4 is not part of the proposed remedy. It could be utilized as a remedy extraction well because it can be retrofitted for extraction from contaminated aquifers. If it is not used, it may be a conduit for migration into deeper aquifers of constituents having a specific gravity heavier than water. (City of Santa Fe Springs) ***Response: EPA did not include specific extraction well locations in the alternatives described in the Feasibility Study. The locations indicated on the figures in the FS and in the ROD are for illustration and costing purposes only. The use of this specific well (well No. 4) as an extraction well for the remedy can be considered during the RD phase. Technical considerations, such as hydraulic control of the plume, and stakeholders' input will be key factors that need to be addressed. There are downward hydraulic gradients within the aquifer in the OU2 area, and there is a potential for vertical migration of contaminants dissolved in groundwater through conduits including active and inactive wells. These issues will need to be evaluated during the remedial design.***
37. The remedy should be implemented immediately to protect drinking water wells. WRD supports the Remedial Action Objective to decrease plume spreading. (City of Lakewood and WRD) ***Response: EPA agrees and has opted to pursue an interim containment remedy that can be selected and implemented in a more timely manner than would be the case for a full final remedy for groundwater. EPA recognizes that it will require extensive effort and will work with all stakeholders to implement the remedy as quickly as possible.***
38. WRD requests EPA's response to a technical memorandum prepared by WRD's contractor in addition to responding to WRD's public comments. (WRD) ***Response: EPA believes that WRD's written public comments summarized the issues identified in the technical memorandum. EPA is responding to WRD's comments in this Responsiveness Summary.***
39. EPA should be mindful of water rights negotiations and the time that will likely be required to reach an agreement among stakeholders. The FS does not analyze how the remedy will impact GSWC's water rights. EPA's Feasibility Study and Proposed Plan ignore the issue of water rights. Whose groundwater rights will be used for the extraction and who will pay replenishment assessment fees? (WRD, GSWC, OPOG and Central Basin Municipal Water District) ***Response: EPA is aware of the water rights issues and understands the need to address this during the RD phase of the project. EPA will, as appropriate, participate in discussions and help facilitate agreements between stakeholders. If EPA is successful in reaching an agreement with the PRPs to implement the remedy, it will be their***

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responsibility to address the water rights issues. EPA expects that the PRPs implementing the remedy will enter into an agreement with one or more water rights holders and groundwater will be extracted under the holder's water rights. If agreement can not be reached with a water rights holder in a timely manner, the treated water may be reinjected.
40. The remedy impacts on this community are substantial and long-term. EPA should provide technical assistance to the affected community. The Proposed Plan document mentions that a Technical Assistance Grant (TAG) is available for citizens who live near a Superfund site. A TAG requires application by a local non-profit organization to represent the local community. It appears that no non-profit organization has applied for and been accepted as the community representative for a TAG. The affected community, including the water agencies should be made aware that a Technical Advisor (TA) can be provided to the affected community by the EPA Technical Assistance Services for Communities (TASC) program. Because some municipal drinking water wells have been impacted, and the drinking water system is the proposed recipient of the treated groundwater, if no community group is formed to represent the community interest, a municipal agency may desire to fill this role. (T3W Business Solutions, Inc.) ***Response: Eligible community group(s) can apply for a Technical Assistance Grant (TAG) by contacting Jackie Lane, Community Involvement Coordinator at (415) 972-3236 or email her at lane.jackie@epa.gov. To date, no community group has submitted a "Letter of Intent" to apply for a TAG. In addition, according to the October 2000 TAG Rule (60 Fed. Reg. 58850, 58860 (2000) (to be codified at 40 CFR Part 35, §35.4200 (b)(5)), a municipality is ineligible to apply. General TAG program and resource information is available at http://www.epa.gov/superfund/community/tag/index.htm. Interested stakeholders who would like to apply for Technical Assistance Services for Communities (TASC) program can call Viola Cooper, Region 9 TASC coordinator at (415) 972-3243 or email her at cooper.viola@epa.gov. For general TASC information, go to http://www.epa.gov/superfund/community/tasc/***

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41. The FS and the Proposed Plan characterize the Site and the surrounding areas as "predominantly commercial/industrial with minor residential land use." This is not correct. There is a substantial residential area in OU2 roughly south of Florence Avenue, east of Pioneer Boulevard, north of the Imperial Highway, and west of Bloomfield Avenue. There may be another impacted well south of the leading edge of the plume as shown in the FS, east of Norwalk Blvd. in the vicinity of San Antonio Dr. This indicates that OU2 should be extended to the south of where it is shown in the FS, and residential neighborhoods in Norwalk south of the Golden State Freeway should be included in OU2. (T3W Business Solutions, Inc.) ***Response: EPA acknowledges that there are residential areas within and near OU2, but the majority of land use overlying the OU2 plume is commercial/industrial. EPA has also reviewed information on production wells in the OU2 area and further south and southwest (downgradient) of the plume. EPA is selecting an interim containment remedy that is intended to protect these downgradient production wells. EPA will expand the boundary of OU2 if it is confirmed that the plume is continuous beyond the extent currently shown.***
42. CDPH recommends its early involvement in the remedy implementation. (CDPH) ***Response: EPA agrees that CDPH needs to be involved at the outset of remedy implementation. EPA fully expects to continue past discussions with CDPH through the remedial design and remedy implementation phases of the project.***
43. There is no evidence that the contamination from the Site is not being drawn down to a deeper layer of the aquifer in the area of the GSWC wells and, given the geology of the area and GSWC's usual pumping pattern, it is highly likely this is already occurring. (GSWC) ***Response: EPA concurs with GSWC that past and current pumping from the Pioneer and Dace wells has likely drawn contamination down into deeper aquifer zones. Additional investigation is needed to better define the influence of these wells on the OU2 plume.***
44. EPA stated that the State had accepted the Proposed Plan because DTSC supported the preferred remedy but no mention is made of CDPH and whether EPA has gained CDPH's acceptance. (GSWC) ***Response: DTSC is the lead state agency for the Site and, in that capacity, concurred on the Proposed Plan. DTSC has also concurred on the remedy selected in this ROD. At this Site, as at others, EPA relies upon the lead state agency to consult with its sister agencies when necessary and appropriate. EPA recognizes CDPH's key role and***

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regulatory authority relating to implementation of the selected interim remedy and anticipates it will be actively involved moving forward. EPA has had substantive discussions with CDPH in the past several months regarding the interim remedy and expects to continue coordinating with CDPH through the remedial design and remedy implementation phases of the project.
45. Table 5-18 of the RI does not include GSWC data that EPA collected in 2010. (GSWC) ***Response: Table 5-18 of the RI lists the maximum MCL exceedances. Concentrations measured in samples taken from the GSWC wells were not the highest detected at OU2 and thus are not listed in the table. The RI/FS section on production wells (Section 4.6 of the final RI/FS report) was updated to include the 2010 data collected from GSWC.***
46. In the Proposed Plan, EPA did not adequately summarize its overall strategy for remediating the Site (e.g., further studies and additional remedial actions) or how the interim remedial action fits into that overall strategy. (GSWC) ***Response: EPA believes the Proposed Plan presented an adequate summary of its overall strategy and how the interim remedial action fits into that strategy. The Plan notes that, following implementation of the selected interim remedy for OU2, EPA will conduct further studies and expects to propose additional remedial actions for the OU2 plume as part of the final cleanup remedy for the Site. As part of those studies, EPA will work with the State to identify all significant sources within the OU2 plume area that have contributed to the groundwater. Although some of the known sources are currently being addressed by State-led actions, the Plan notes that EPA expects that the remainder of the sources identified will be addressed by the combined efforts of the State and EPA.*** ***The Plan also discusses how the interim remedial action fits into the overall cleanup strategy for the Site. It describes the other operable units at the Site and the cleanup and enforcement activities that have been and are being taken to address each.***

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47. The FS does not explain why GSWC is excluded from periodic meetings between EPA and State and local entities. (GSWC) ***Response: EPA is aware of and appreciates GSWC's active interest in the OU2 cleanup actions and will continue to include GSWC in future stakeholder meetings whenever appropriate. EPA meets frequently with state regulatory agencies and a key topic is often enforcement actions. It would be inappropriate to include GSWC or any other non-governmental entity in such discussions. EPA first contacted GSWC in April 2009, during preparation of the RI/FS, has met with GSWC several times (on-on-one and at other water agency meetings), and has participated in teleconference calls when requested.***
48. Correct the information in the Proposed Plan regarding the Watermaster <u>and</u> note that that Central Basin is granted statutory powers under the Water Code (Central Basin Municipal Water District) ***Response: EPA agrees. The Proposed Plan identified the Water Replenishment District as the "Acting Watermaster." The Department of Water Resources (DWR) is correctly identified as the Watermaster in the ROD.*** ***The Central Basin Municipal Water District (CBMWD) is mainly responsible for importing supplemental water through Metropolitan Water District. EPA expects that the responsible parties implementing the remedy will involve CBMWD as appropriate.***
49. Central Basin Municipal Water District asked for additional time to review the feasibility analysis and requested that EPA provide the related documents for review. Without Central Basin Municipal Water District's input, the alternatives may not be feasible. Central Basin Municipal Water District offers assistance with the distribution of the treated water. (Central Basin Municipal Water District) ***Response: EPA released the Proposed Plan in August 2010 to the public and encouraged stakeholders to present comments. The Proposed Plan presents a proposed remedy selected from among remedial alternatives developed in the RI/FS; the RI/FS includes the feasibility analysis and was also made available to the public in August 2010. EPA extended the review period an additional two months (through November 22, 2010) to provide additional review time for comments on the Proposed Plan and its supporting information. EPA did not grant Central Basin Municipal Water District additional time beyond that extended comment period.*** ***If EPA is successful in reaching an agreement with the PRPs to implement the remedy, it will be their responsibility to enter into agreements. EPA acknowledges and appreciates the District's offer and will contact the District when the RD starts. EPA looks forward to working with CBMWD in helping to facilitate an agreement between stakeholders.***

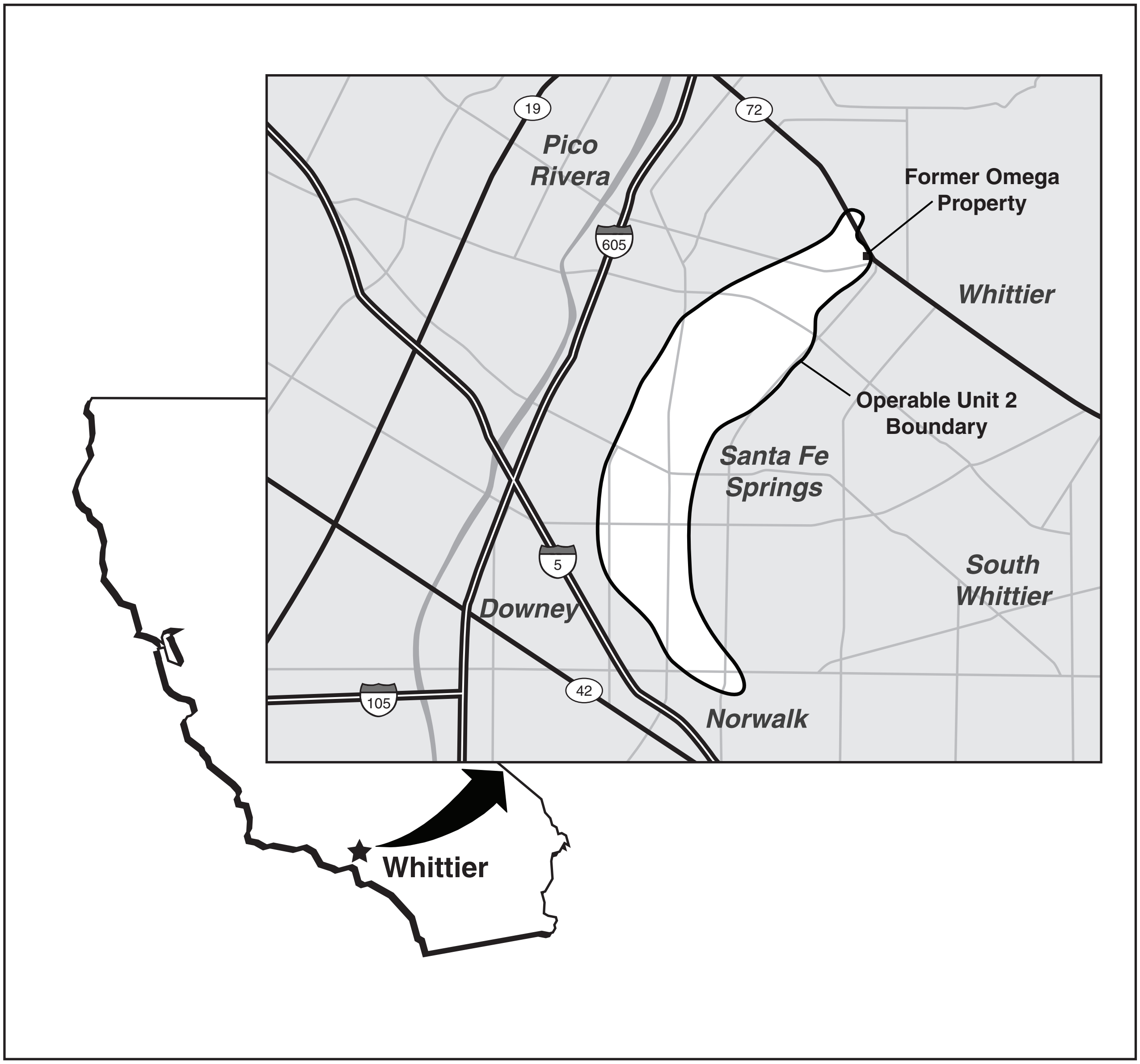

Figure 1: OU2 Location

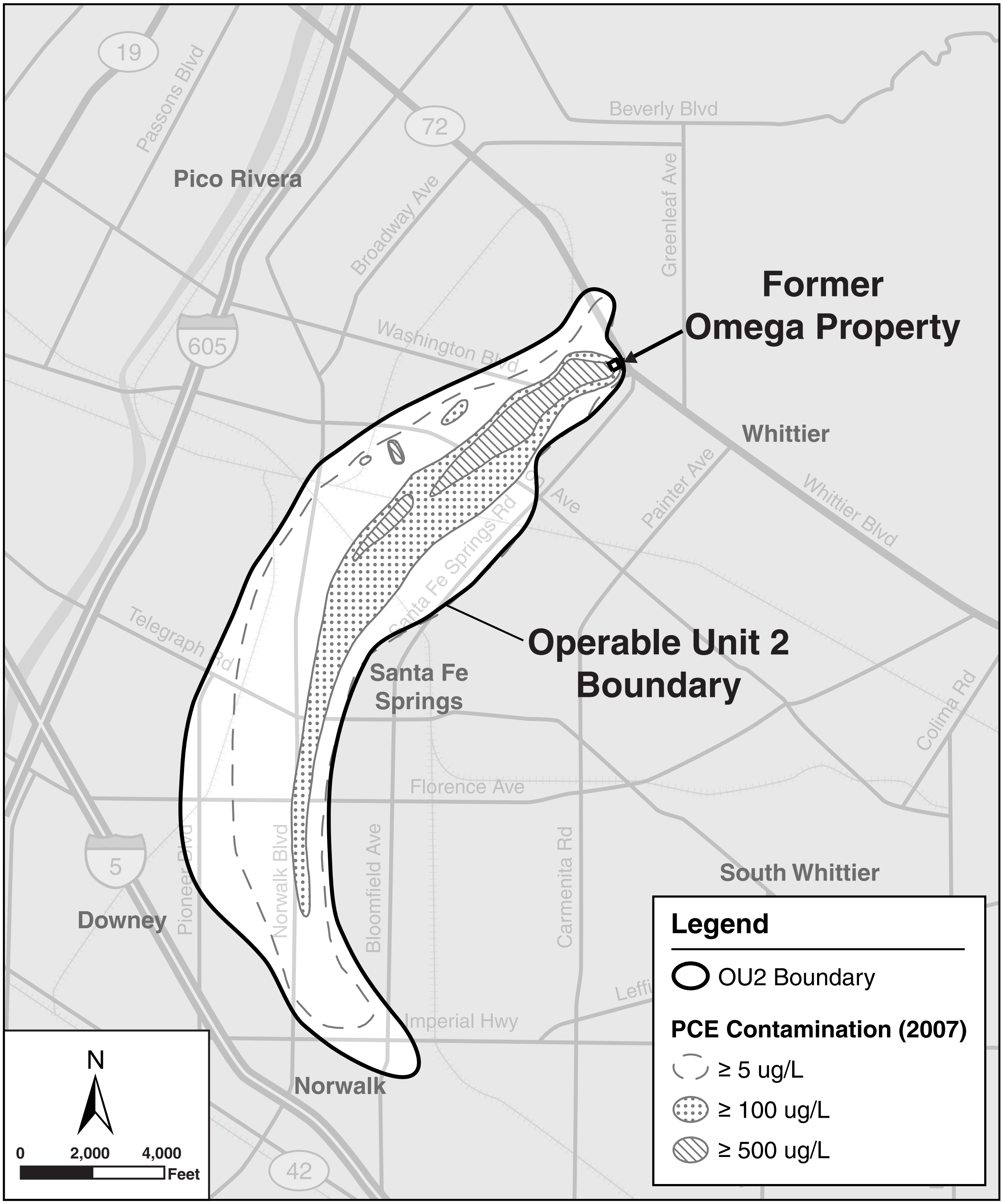

Figure 2: OU2 Extent of Tetrachloroethylene (PCE) Groundwater Contamination

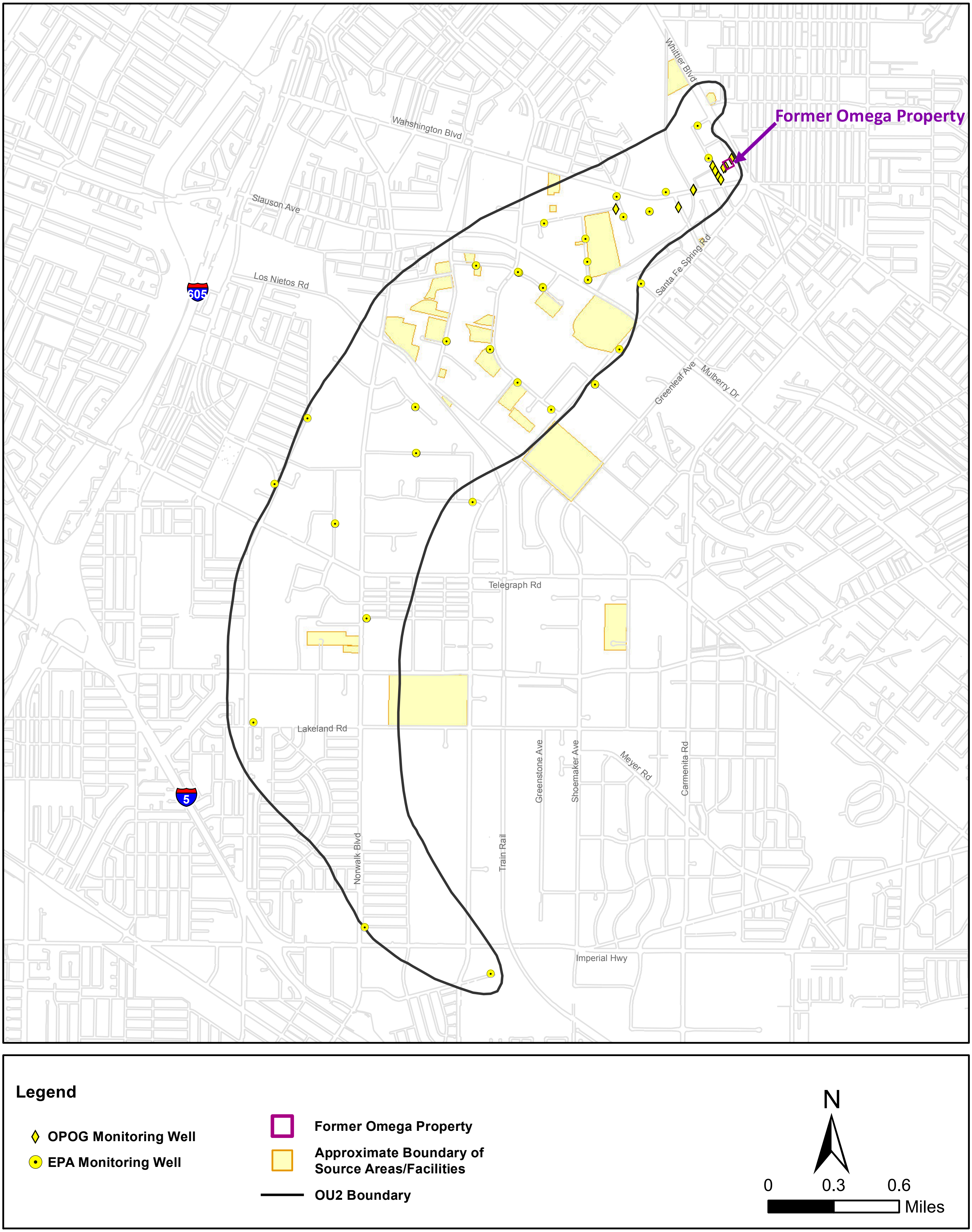

Figure 3: Source Areas and Monitoring Well Locations

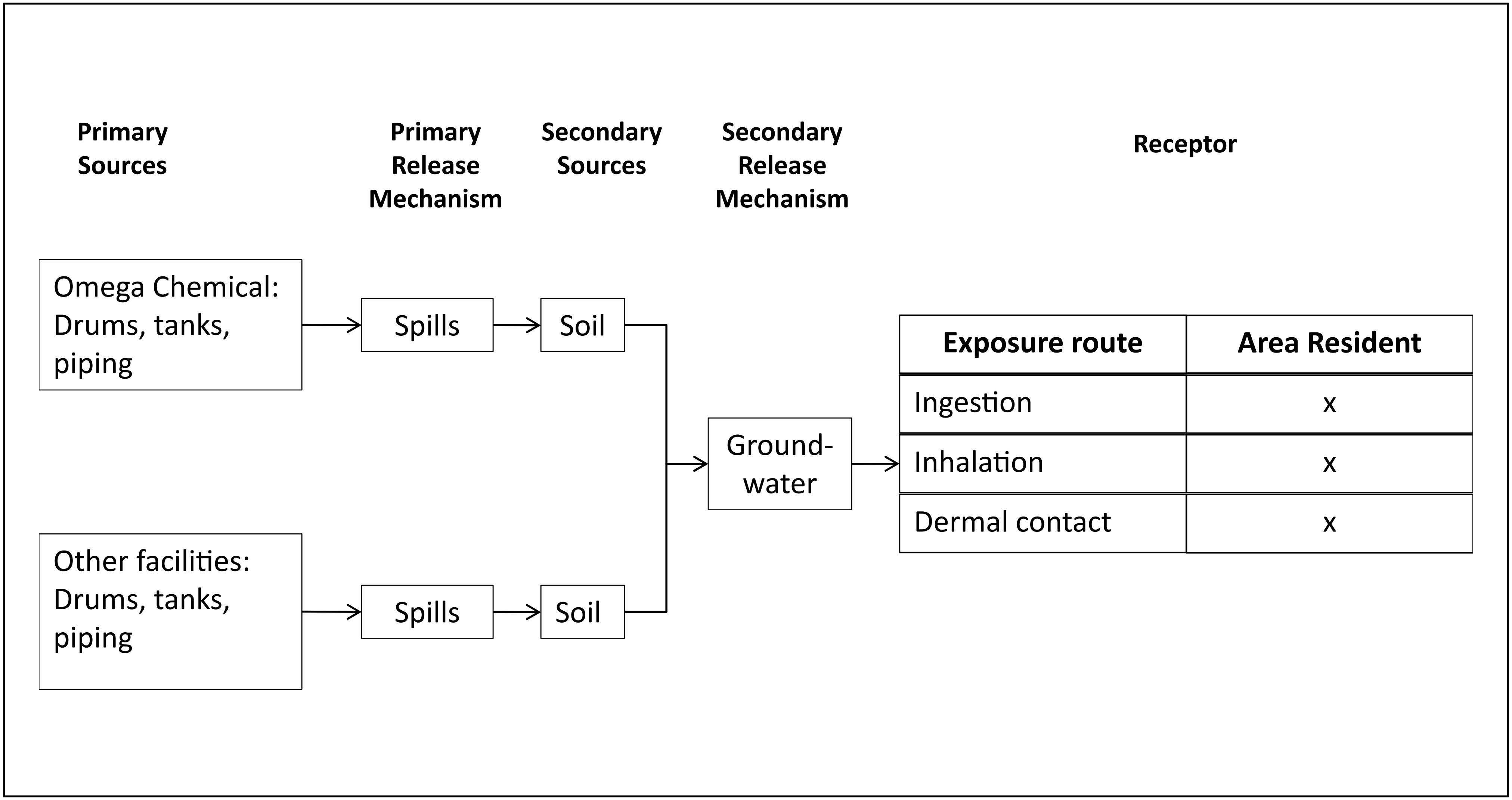

Figure 4: Conceptual Site Model

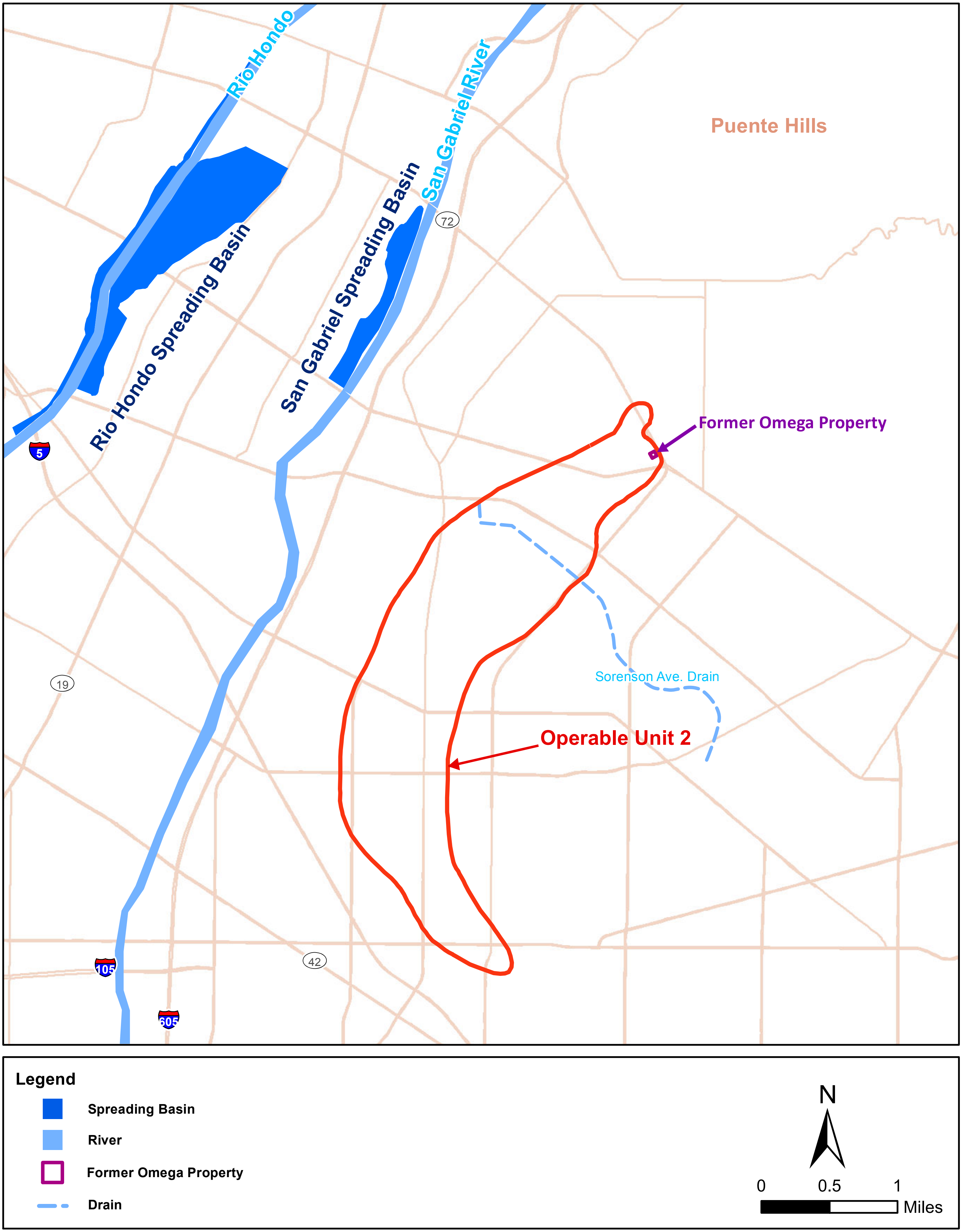

Figure 5: Surface Streams and Spreading Basins in OU2 Area

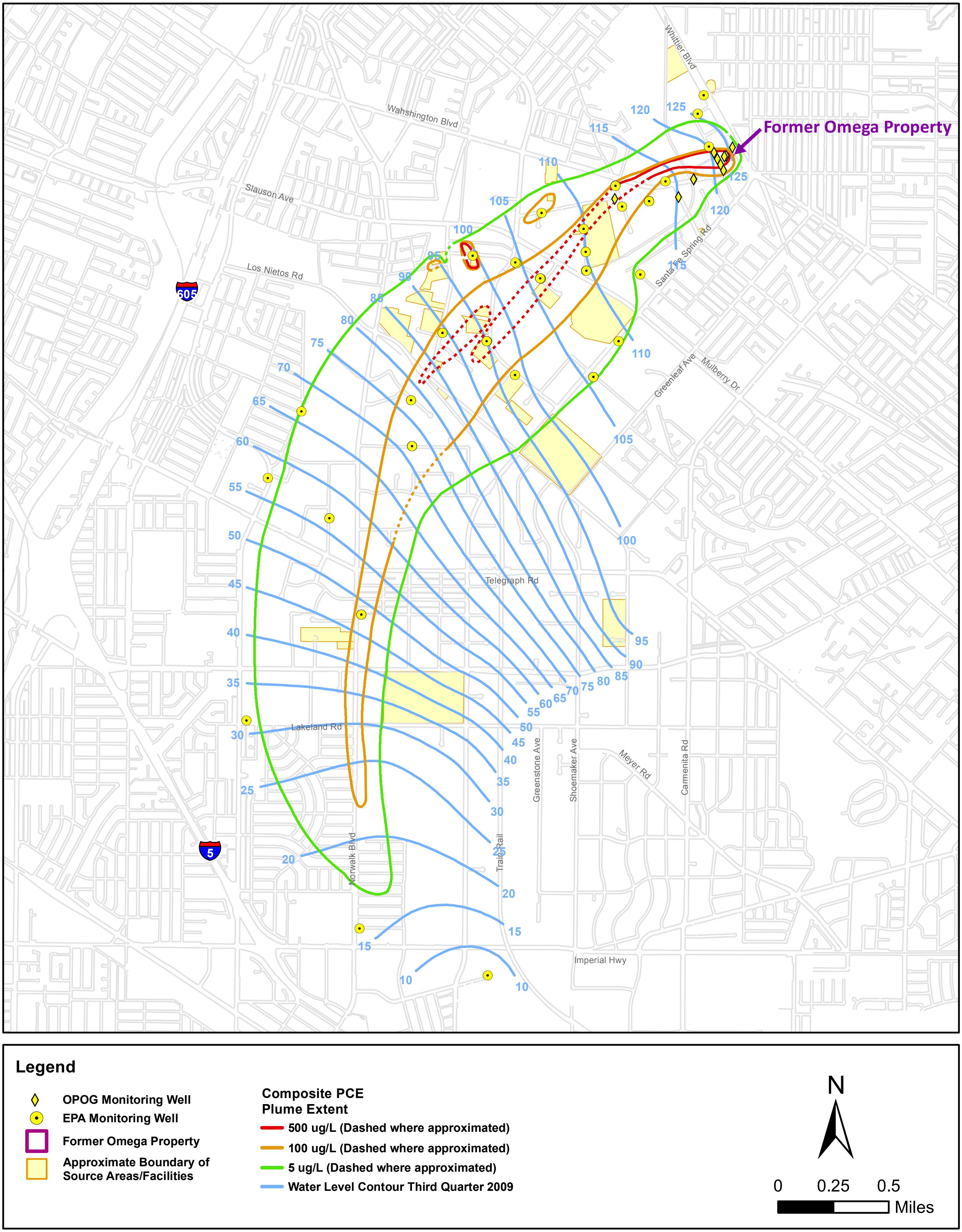

Figure 6: September 2009 PCE Plume

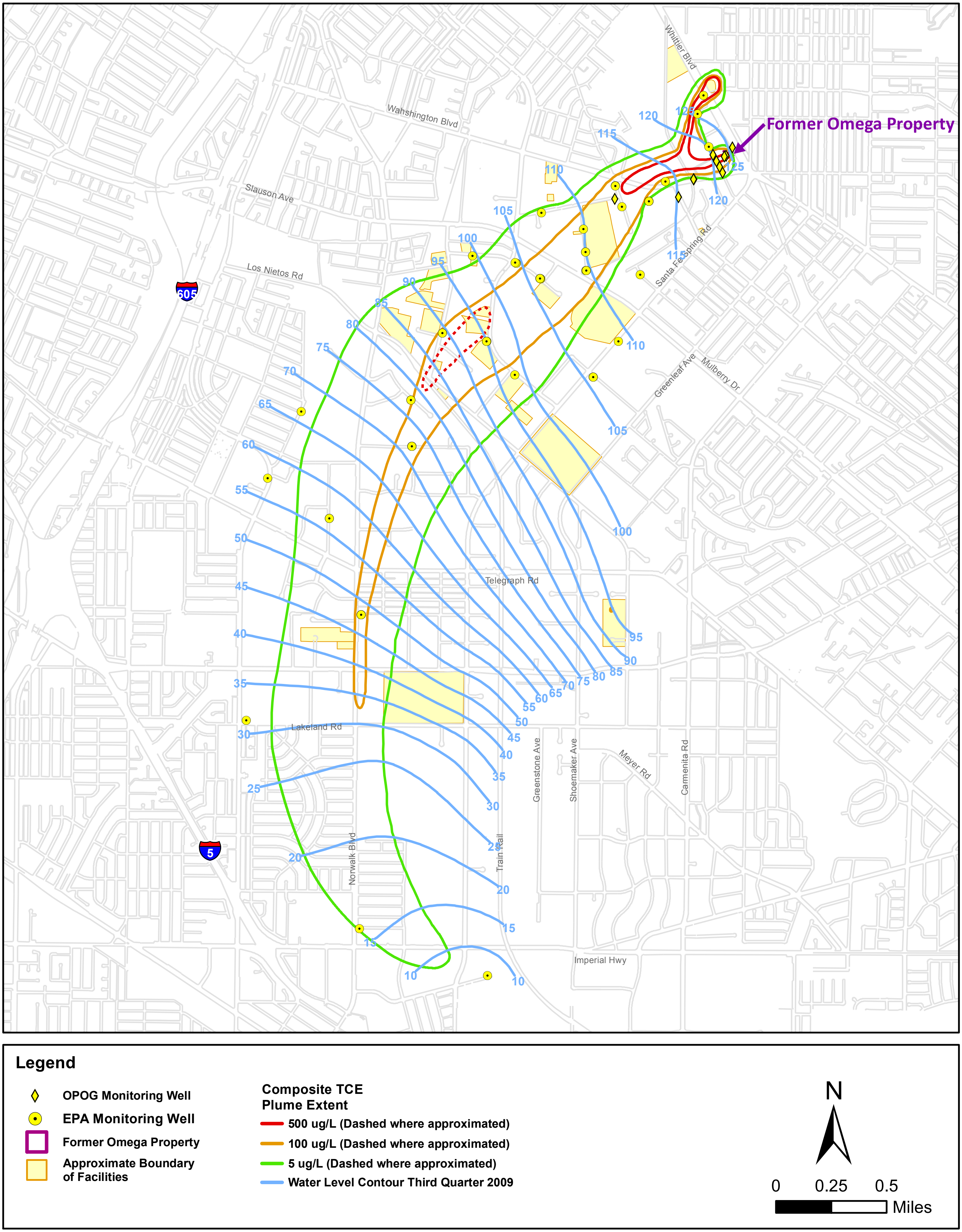

Figure 7: September 2009 TCE Plume

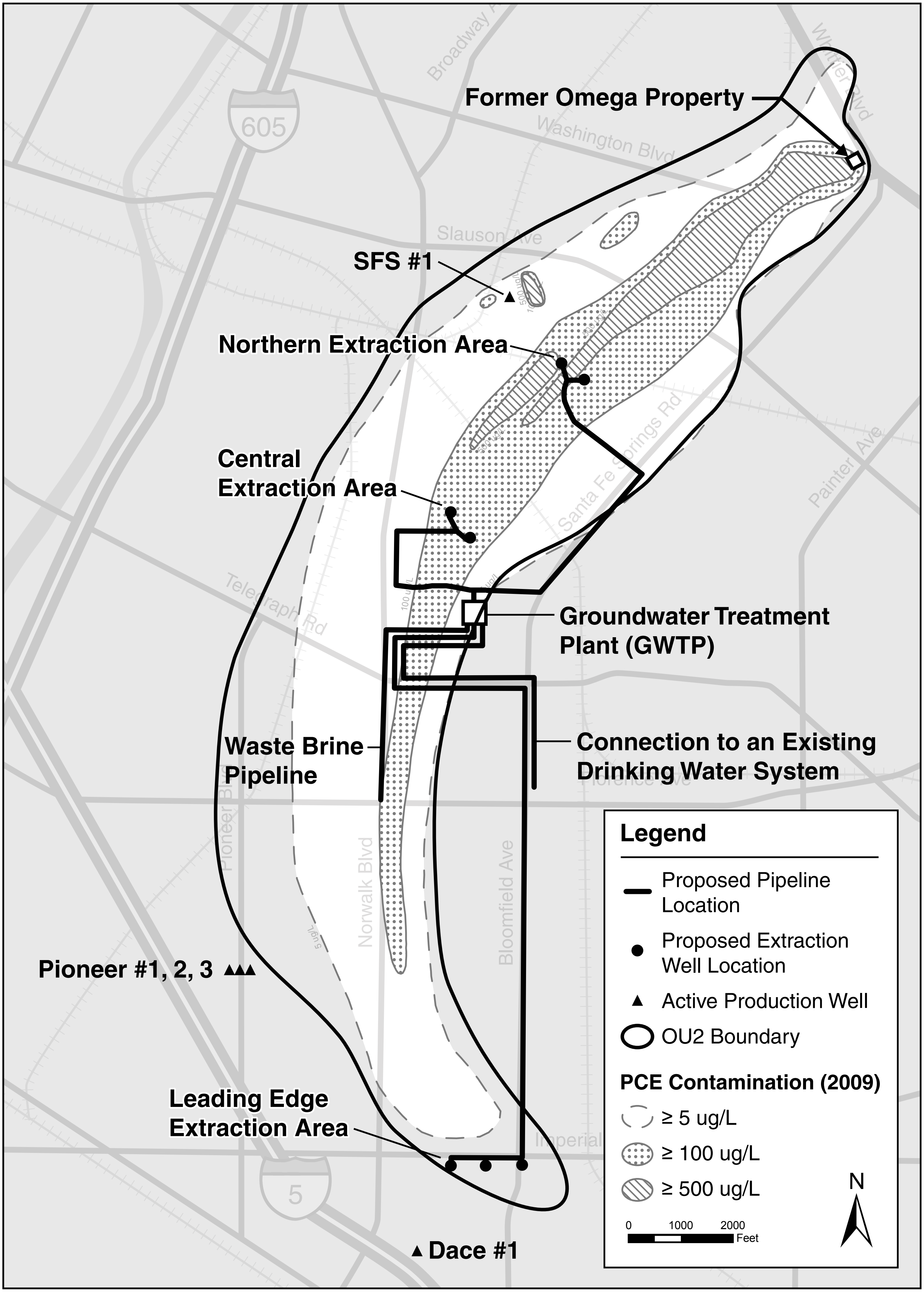

Figure 8: Schematic of Selected Remedy

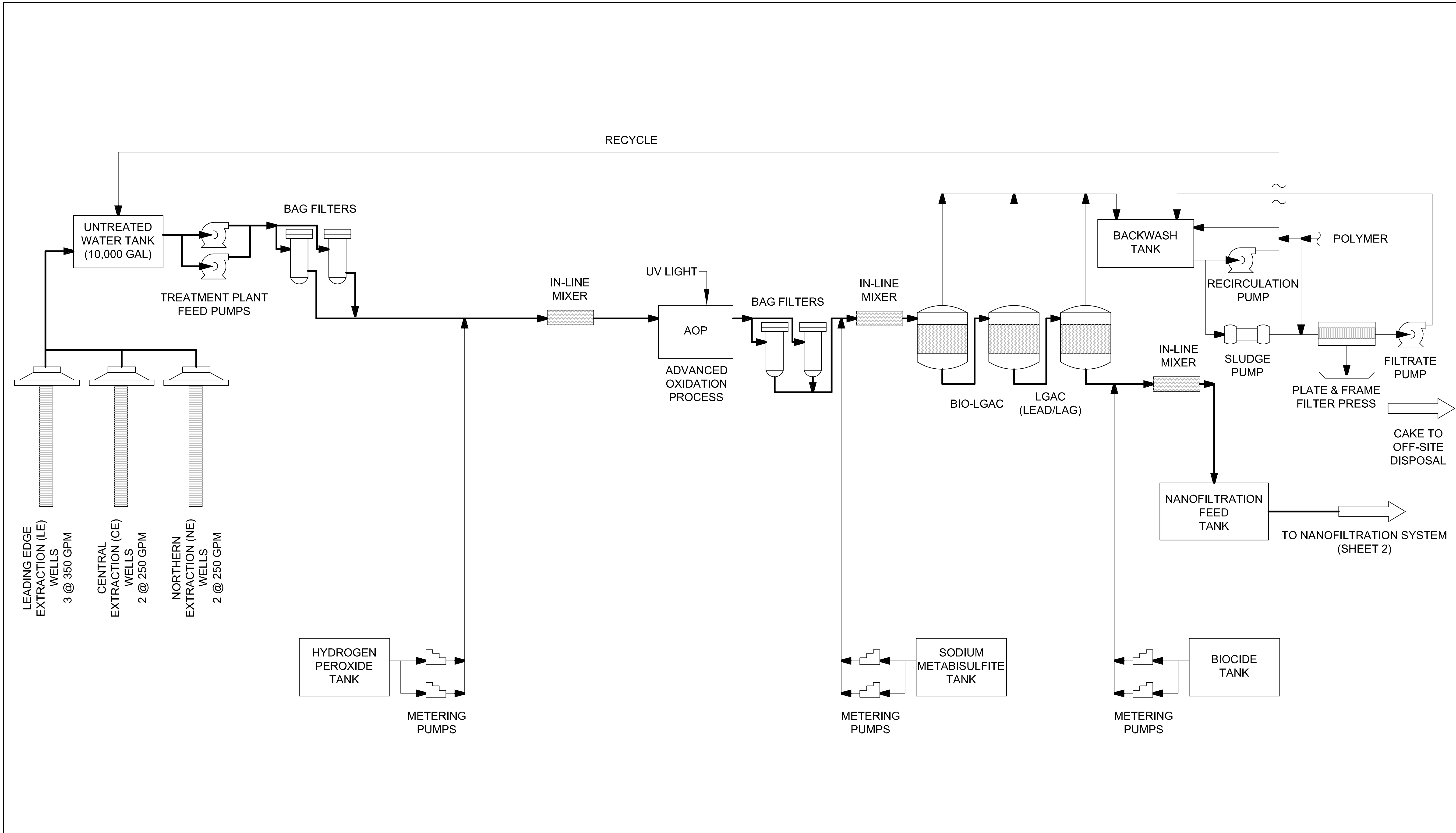

Figure 9: Process Flow Diagram of Selected Remedy (Sheet 1 of 2)

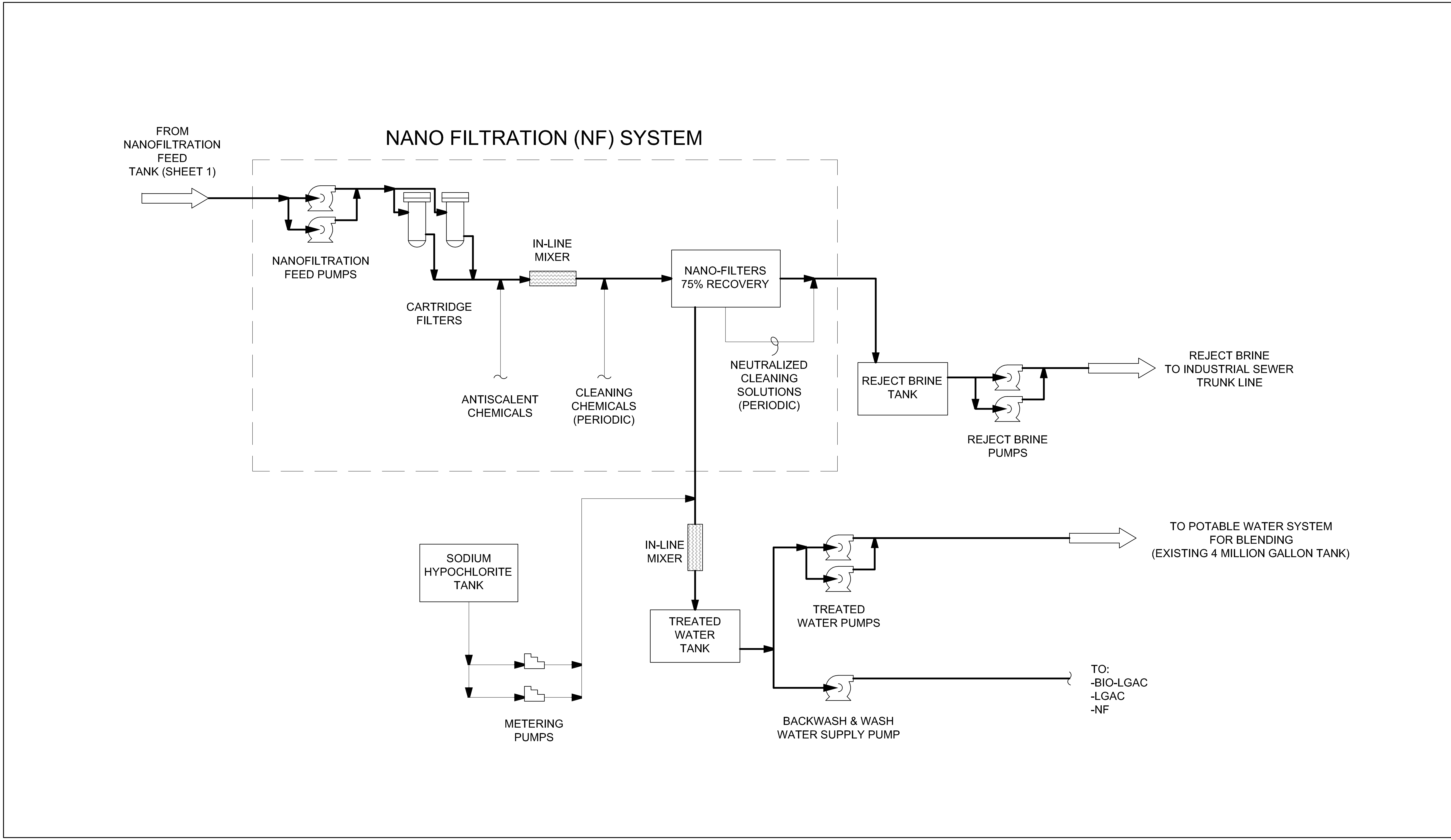

Figure 9: Process Flow Diagram of Selected Remedy (Sheet 2 of 2)